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AN EXERCISE BOOK IN ARITHMETIC

ORAL AND WRITTEN

FOR SUPPLEMENTARY OR INDEPENDENT USE
IN HIGHER GRADES, NORMAL SCHOOLS,
AND GENERAL REVIEW CLASSES

BY

GORDON A. SOUTHWORTH
SUPERINTENDENT OF SCHOOLS, SOMERVILLE, MASS.
FOR FIFTEEN YEARS

AND

JOHN C. STONE, A.M.
HEAD OF THE DEPARTMENT OF MATHEMATICS, STATE NORMAL SCHOOL,
MONTCLAIR, NEW JERSEY, CO-AUTHOR OF THE SOUTHWORTH-STONE
ARITHMETICS, STONE-MILLIS SECONDARY ARITHMETIC,
ALGEBRAS, GEOMETRIES, ETC.

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BENJ. H. SANBORN & CO.
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PREFACE

THIS *Book of Exercises in Arithmetic* is written to supply a demand for just such a book in the higher grades, in normal schools, and in general review courses.

A general course in arithmetic should not attempt to meet the needs of a particular vocation, but should aim rather to develop:

(*a*) Accuracy and some speed in the fundamental processes;

(*b*) Skill in simple mental calculations;

(*c*) A mastery of common fractions and power to use fractional relations;

(*d*) Absolute accuracy in the use of the decimal point;

(*e*) Facility in the use of the common tables of weights and measures;

(*f*) A knowledge of common business forms and methods; and

(*g*) The power to reason correctly in the face of rather complicated data.

All this should be done through drills and the applications of arithmetic to present-day usages and customs in the commercial and industrial world — percentage and simple measurements. Hence, no attempts are made to teach statistical industrial facts nor to give general encyclopedic information.

Part I consists of abstract drills, many of them in script for sight work to save time in copying. These are designed for daily use. (See Suggestions to Teachers.)

Part II is free from puzzles and obsolete matter. The problems are true to present-day commercial and industrial life, and are designed to perform two functions; viz. to teach the practical use of number and to develop arithmetical power. In general, the problems are so selected that they offer a choice of several solutions, thus developing the power to judge and to choose.

Part III is taken from recent examinations in many of our best schools, thus showing the trend of instruction and requirements. They may be used for tests or general classroom work.

The thanks of the authors are due to superintendents and others who have kindly furnished copies of test problems.

G. A. S.
J. C. S.

APRIL, 1910.

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SUGGESTIONS TO TEACHERS

1. The **Drill Tables** are given in script to save the time of copying. In their use in "sight work" results are to be announced rapidly. In "written work" figures are not to be copied, but results only are to be written.

These drill tables may be used in a variety of ways, and each day's lesson may well begin with a few minutes of drill until the desired degree of accuracy and speed is secured. Table I, page 1, gives exercise in the forty-five primary combinations. It is very desirable that pupils should be able to announce instantly the sum of at least five digits. Any of the first five tables will afford drill in this line. The sum of the digits or of the numbers in any line or column may be written. The sum of twelve five-place numbers should be found in one minute or less.

In the same way most of the tables may be utilized in giving at sight differences, or products, or quotients of adjacent digits or numbers.

So, too, the drill tables in fractions and percentage should be freely used. The point to be constantly kept in mind is that in business we deal chiefly with small numbers held in the mind, and the power to give the combinations, differences, and relations of business numbers quickly and accurately is absolutely essential to success.

2. **Part II** furnishes a diversified list of well-graded and very practical problems, including all the essentials of arithmetic. The pupil should study each problem well, and select

the method of procedure that seems to him best, — that is, the method that will require the least computation. No fixed stereotyped form of analysis should be required, but rather the pupil should state clearly the relations that he sees will give him the solution. Encourage pupils thus to exercise a choice of methods and to defend the choice they make.

In many of the problems, particularly those of mensuration, if *all* the work to be done is indicated before any computation is made, certain numbers may generally be combined or canceled, thus greatly abridging the work of computation.

Impress upon the pupils that in the business world "time is money," and to succeed they must be quick as well as accurate, and that all unnecessary work must be eliminated.

3. **Part III** provides additional problems arranged mostly in examination groups of ten. These give supplementary practice and afford a means of testing the pupil's attainment.

The authors believe that a logical inductive development of a subject or process renders rules needless and is far better than mechanical methods. Nevertheless they have inserted several pages of rules, partly because some pupils using the book are more or less dependent upon them, and partly because, when a process is clearly understood, a succinct formulation of it may well be called for, and the printed rule gives the pupil a standard for comparison with his own effort.

Tables of the Common and Metric Measures have been provided for reference and will be found with "Rules" in the Appendix.

AN EXERCISE BOOK IN ARITHMETIC

PART I

DRILLS IN THE FUNDAMENTAL PROCESSES

CHAPTER I

INTEGERS

Drill in Addition — Sight Work

TABLE I

A	124	264	157	868	189	139
	135	137	664	883	539	964
B	267	678	254	359	398	777
	451	789	249	589	187	767
C	137	136	586	368	596	186
	898	247	763	294	534	746
D	379	397	194	287	687	944
	316	839	459	156	323	638
E	957	568	378	479	979	493
	938	156	763	496	136	119

TABLE II

A	41 1	37 7	45 7	92 4	69 9	84 5	11 6	38 9	75 9	52 7
B	94 4	67 2	31 2	83 4	42 3	95 6	63 5	81 7	44 8	39 2
C	75 8	92 2	37 8	86 6	61 3	36 8	84 6	92 8	46 9	73 7
D	63 3	56 7	13 9	81 4	35 5	42 6	98 8	63 8	81 8	49 3
E	37 3	41 5	28 5	14 7	63 6	57 9	32 9	81 9	48 3	14 9
F	12 25	35 38	15 19	65 88	38 81	55 75	34 69	53 93	74 67	63 87
G	64 37	26 14	26 26	15 27	45 46	33 54	49 58	62 79	92 46	49 86
H	71 98	11 57	51 66	26 37	13 35	52 84	32 76	27 98	48 79	24 78

Addition by Grouping

Take advantage of groups of 10 or 20:—

TABLE III

A	B	C	D	E	F	G	H	I	J	K
2	1	8	7	8	3	7	3	3	5	2
4	9	7	3	4	6	2	3	9	7	1
6	7	5	9	8	3	8	9	6	8	9
8	3	2	6	6	8	3	3	4	6	6
3	2	1	4	2	7	6	2	8	6	8

Adding Horizontal Lines

TABLE IV

A	52,341	34,683	97,645	84,369
B	69,578	79,639	18,764	39,676
C	78,963	93,765	37,842	39,678
D	96,384	19,876	30,907	34,698
E	84,375	26,897	48,321	86,978
F	32,937	29,189	83,965	72,346

Written Work in Addition

Record the sum of each column separately without rewriting.

Practice daily until you can add every column in three minutes.

A	B	C	G	H	
3786	9427	3824	9346	84957	a
2463	8947	8643	9157	37863	b
9374	8396	7850	3986	73843	c
3085	9638	3496	8437	86349	d
5693	1847	3894	7683	47384	e
D	E	F	9362	14693	f
7963	8478	3963	8439	84376	g
8339	7496	8397	3986	74932	h
8493	8634	3896	7847	98967	i
1978	3896	2784	7638	74963	j
8471	5739	1875	2936	73894	k
2936	1982	9261	3098	13739	l

Sight Work in Subtraction

TABLE I

A	4 3	4 2	4 3	5 2	5 3	8 5	9 6	5 4	6 5	6 2
B	6 4	6 3	7 6	7 3	7 5	7 4	7 2	8 6	8 2	8 7
C	8 3	8 4	8 5	9 2	9 8	9 6	9 3	9 5	9 4	9 7
D	10 1	13 4	21 9	11 2	42 9	10 3	11 3	14 9	12 7	11 6
E	14 5	16 9	10 2	15 7	14 6	16 7	10 4	11 7	14 8	13 8
F	10 9	12 3	13 5	11 9	12 9	13 6	11 4	13 7	10 5	11 8
G	15 9	17 8	15 8	12 5	10 7	11 5	14 7	10 6	13 9	12 8

Announce the figures of the remainder, beginning at the right:—

Note to Teacher. This table can be utilized for the sum of two digits, as Table I, page 1.

TABLE II

1.	93420376983214637830 18473924396844396897
2.	76304296031046983420 18976439362843998396
3.	69308963894032963801 18939684936743969934
4.	80463009834012846984 17648524968839497693
5.	70037165098039006987 17897349739643658796
6.	97037100693854237108 79689382926198473569
7.	26783010076348937896 25936473194876392937

Sight Work in Multiplication

Give the figures of the product, beginning at the right: —

1.	15349687314297684329 2
2.	74382439876439718435 3
3.	35279816429378546938 4
4.	46391784346893527936 5
5.	35483976348296879379 6
6.	92348796369785943682 7
7.	16498376984329387643 8
8.	37846839745398678439 9

Written Work in Multiplication — Special Case

Multiplying by short methods.

The following will show the method: —

Ex. 1. Multiply 273 by 856.

$$\begin{array}{r} 273 \\ \underline{856} \\ 218400 \\ \underline{15288} \\ 233688 \end{array}$$

EXPLANATION. Observing that 56 is a multiple of 8 and that 56 × 273 = 7 × 8 × 273, we first find 800 × 273. Then, 7 × 2184 will give 56 × 273. Adding, the total product is 233,688.

Ex. 2. Multiply 42,683 by 72,936.

$$\begin{array}{rl} 42683 & \\ \underline{72936} & \\ 38414700 & = 900 \times 42683 \\ 1536588 & = 36 \times 42683 \quad \text{How obtained?} \\ \underline{3073176000} & \underline{= 72000 \times 42683} \quad \text{How obtained? (Two ways.)} \\ 3113127288 & \end{array}$$

1. 742 × 968.
2. 729 × 846.
3. 637 × 453.
4. 735 × 864.
5. 637 × 459.
6. 927 × 824.
7. 848 × 654.
8. 654 × 729.
9. 35,742 × 87,638.
10. 56,872 × 97,635.
11. 42,847 × 37,698.
12. 95,463 × 72,841.
13. 36,972 × 84,639.
14. 48,966 × 79,486.
15. 56,728 × 39,624.

Sight Work — Cross Multiplication

Write the products of the following: —

When there are but two figures in each factor, the work is easily kept in mind and the complete product written down at once.

Find the product of 48 × 36.

$$\begin{array}{r} 48 \\ \underline{36} \\ 1728 \end{array}$$

METHOD. 6 × 8 = 48. Write 8, carry 4. 6 × 4 + 3 × 8 + 4 (carried) = 52. Write 2, carry 5. 3 × 4 + 5 (carried) = 17.

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
54	98	86	73	65	45	89	43
27	43	35	24	37	84	44	98

9.	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**
76	59	84	38	96	34	42	43
49	65	75	46	87	79	63	65

17. 46 × 23.
18. 38 × 65.
19. 42 × 96.
20. 84 × 27.
21. 35 × 64.
22. 72 × 86.
23. 43 × 19.
24. 82 × 96.
25. 34 × 71.
26. 46 × 59.
27. 24 × 13.
28. 26 × 23.
29. 54 × 13.
30. 63 × 24.
31. 73 × 36.

Special Cross Multiplication

Two special cases are shown below.

Ex. 1. Find the product of 74 × 76.

$$\begin{array}{r}74\\ \underline{76}\\ 5624\end{array}$$

Explanation. 6 × 4 = 24. Then, 6 × 70 + 70 × 4, or 6 × 70 + 4 × 70, is 10 × 70. Next, we have 70 × 70. Hence, in all, we have 70 × 70 + 10 × 70 + 24 = 80 × 70 + 24 = 5624.

> *When the number of tens is the same in both factors, and the sum of the ones is ten, we take the product of the number of tens by the next higher number, and annex the product of the ones.*

Thus, 34 × 36 = 1224; 82 × 88 = 7216; 93 × 97 = 9021; 72 × 78 = 5616.

Ex. 2. Find the product of 66 × 37.

$$\begin{array}{r}66\\ \underline{37}\\ 2442\end{array}$$

Explanation. 7 × 6 = 42. Then, 7 × 60 + 3 × 60 = 10 × 60. Next, 30 × 60. Hence, in all, the products are 30 × 60 + 10 × 60 + 42 = 40 × 60 + 42.

When both figures of the multiplicand are the same, and the sum of the numbers represented by the figures of the multiplier is ten, we annex the product of the ones to the product of the number of tens in the multiplicand by the number in the multiplier increased by one.

Thus, 44 × 64 = 2816; 66 × 82 = 5412; 33 × 73 = 2409; 44 × 91 = 4004.

At sight, give the products: —

1. 23 × 27.
2. 16 × 14.
3. 18 × 12.
4. 26 × 24.
5. 32 × 38.
6. 46 × 44.
7. 33 × 28.
8. 44 × 64.
9. 55 × 82.
10. 33 × 73.
11. 44 × 19.
12. 55 × 28.
13. 21 × 29.
14. 42 × 48.
15. 66 × 19.
16. 54 × 56.
17. 77 × 28.
18. 88 × 46.
19. 93 × 97.
20. 81 × 89.
21. 99 × 37.
22. 88 × 64.
23. 84 × 86.
24. 94 × 96.

25. Why is the square of a number ending in 5 a special case of Exercise 1?

26. Square the following: —

25; 45; 35; 65; 85; 55; 95; 75; 105; 115.

Multiplying by Aliquot Parts

Give the following: —

½ of 10.
⅓ of 10.
¼ of 10.
⅓ of 100.
¼ of 100.
⅙ of 100.
⅛ of 100.
1/12 of 100.
1/16 of 100.
⅐ of 100.
⅑ of 100.
⅛ of 1000.

Memorize this table: —

25 = ¼ of 100.
33⅓ = ⅓ of 100.
16⅔ = ⅙ of 100.
12½ = ⅛ of 100.
6¼ = 1/16 of 100.
3⅓ = ¼ of 10.
2½ = ¼ of 10.
125 = ⅛ of 1000.

1. Observe the preceding table, and tell how to multiply by 25; by $33\frac{1}{3}$; by $16\frac{2}{3}$; by $12\frac{1}{2}$; by 125; by $6\frac{1}{4}$; by $3\frac{1}{3}$; by $2\frac{1}{2}$.

Give at sight: —

2. $33\frac{1}{3} \times 18$.
3. 25×24.
4. $16\frac{2}{3} \times 54$.
5. 25×96.
6. $6\frac{1}{4} \times 48$.
7. $16\frac{2}{3} \times 36$.
8. $33\frac{1}{3} \times 42$.
9. $12\frac{1}{2} \times 72$.
10. 25×32.
11. $33\frac{1}{3} \times 63$.
12. 25×84.
13. $12\frac{1}{2} \times 24$.
14. $16\frac{2}{3} \times 24$.
15. $12\frac{1}{2} \times 96$.
16. $6\frac{1}{4} \times 64$.

At sight, give the cost of: —

1. 21 lb. coffee at $33\frac{1}{3}$ ct.
2. 48 lb. tea at 25 ct.
3. 24 lb. prunes at $16\frac{2}{3}$ ct.
4. 32 lb. rice at $6\frac{1}{4}$ ct.
5. 48 lb. raisins at $16\frac{2}{3}$ ct.
6. 48 lb. steak at $12\frac{1}{2}$ ct.
7. 54 lb. steak at $16\frac{2}{3}$ ct.
8. 72 lb. lard at $16\frac{2}{3}$ ct.
9. 96 lb. butter at 25 ct.
10. 48 qt. berries at $12\frac{1}{2}$ ct.
11. 9 yd. cloth at 50 ct.
12. 16 yd. cloth at 25 ct.
13. 12 yd. lace at $8\frac{1}{3}$ ct.
14. 36 yd. braid at $8\frac{1}{3}$ ct.
15. 24 yd. cloth at $16\frac{2}{3}$ ct.
16. 96 yd. cloth at $12\frac{1}{2}$ ct.

Dividing by Aliquot Parts — Sight Work

1. Division is the reverse of what process? 2. 25 is what part of 100? 3. How do you multiply by 25 most easily? 4. How do you divide by 10, 100, 1000? 5. Show that dividing by 100 and multiplying by 4 divides by 25.

At sight, announce the quotients: —

1. $40 \div 2\frac{1}{2}$.
2. $60 \div 3\frac{1}{3}$.
3. $300 \div 12\frac{1}{2}$.
4. $800 \div 25$.
5. $1600 \div 33\frac{1}{3}$.
6. $800 \div 16\frac{2}{3}$.
7. $700 \div 6\frac{1}{4}$.
8. $600 \div 11\frac{1}{9}$.
9. $9000 \div 125$.
10. $1500 \div 14\frac{2}{7}$.
11. $1200 \div 66\frac{2}{3}$.
12. $900 \div 37\frac{1}{2}$.
13. $750 \div 62\frac{1}{2}$.
14. $1400 \div 87\frac{1}{2}$.
15. $1230 \div 75$.

Sight Work in Division

Divide each by all numbers from 2 to 12 inclusive, giving quotients and remainders:—

	I	II	III	IV	V	VI
A	18	27	238	256	1346	1349
B	38	64	564	397	1297	1187
C	96	39	973	854	1576	1397
D	47	72	847	781	1684	1268
E	89	56	356	694	1765	1695
F	54	71	918	781	1933	1834
G	63	49	584	908	1564	2348
H	75	66	768	891	1486	2632
I	81	59	690	739	1986	2148
J	99	86	732	547	1348	2526
K	84	77	516	492	1406	2618
L	79	87	477	861	1981	2793

Using the table on page 7, consider the multiplicands as dividends and divide each one by the multiplier used as a divisor, giving the quotient figures. Do not rewrite.

The prices of a dozen articles are given below. Give the price of a single article.

1. \$1.00.
2. \$2.00.
3. \$1.75.
4. \$2.50.
5. \$3.00.
6. \$3.75.
7. \$4.25.
8. \$5.00.
9. \$4.50.
10. \$6.50.
11. \$5.25.
12. \$7.00.
13. \$8.00.
14. \$9.00.
15. \$10.00.
16. \$9.50.
17. \$14.00.
18. \$16.00.
19. \$22.00.
20. \$36.50.

CHAPTER II

FRACTIONS

Fundamental Notions

1. What is a fraction?

2. What is a unit fraction or a fractional unit?

3. Name the terms of a fraction.

4. What is indicated by each term?

5. In $\frac{3}{5}$, how many units are considered?

6. What is the size of each unit in $\frac{3}{5}$? In $\frac{7}{8}$? In $\frac{9}{10}$?

7. To what other fractional units can 3ds be changed? To what can 4ths be changed? 5ths?

8. Make a general statement about the denominators of all fractions to which 3ds can be changed.

9. Make a general statement about the denominator of the largest fractional units to which two or more fractions may be changed.

10. Change $\frac{5}{6}$ and $\frac{7}{8}$ to 24ths; to 48ths; to 72ds.

11. What principle is employed in changing a fraction to a common denominator (common unit)?

12. What is the sum of 4 ft., 8 ft., 12 in., and 3 yd.?

13. What fundamental principle did you apply in adding the numbers in Exercise 12? Is the same principle applied in fractions?

14. How can you add $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$?

15. What is the least common multiple (L. C. M.) of two or more numbers?

At sight, give the L. C. M. of the following: —

16. 2, 3, 5.
17. 2, 5, 7.
18. 3, 5, 4.
19. 2, 8, 9.
20. 2, 4, 6.
21. 2, 3, 9.
22. 3, 6, 11.
23. 5, 6, 12.
24. 5, 8, 12.
25. 6, 9, 15.
26. 7, 14, 11.
27. 7, 9, 3.
28. 3, 9, 7.
29. 5, 10, 9.
30. 4, 8, 11.
31. 6, 12, 13.

NOTE. Notice that when one number is a multiple of some of the others, these other numbers need not be considered. Thus, the L. C. M. of 3, 6, and 11 is the same as of 6 and 11.

32. Which of these fractions are in their smallest terms: $\frac{18}{15}$, $\frac{10}{15}$, $\frac{7}{9}$, $\frac{21}{27}$, $\frac{14}{21}$, $\frac{29}{31}$?

33. When may we change fractions to larger terms?

34. Is it ever absolutely necessary to change fractions to smallest terms? When do you do it?

35. Express $\frac{576}{1728}$ in the smallest possible terms.

36. What is the greatest common divisor of these terms?

37. Compare $\frac{479}{11}$ with $43\frac{6}{11}$. What change did you make before comparison? Which is the simpler of these expressions?

38. What fractional parts of a yard are most commonly used? Of a pound? Of a bushel? Of a dollar? Of an hour?

39. What common unit is used in comparing $\frac{5}{6}$ yd. with $\frac{4}{9}$ yd.?

Sight Work in Addition

1. What general principle underlies all addition? 2. When are fractions "like numbers"? 3. Name some fractions that have a common unit. 4. How are fractions changed to like fractions, or to a *common denominator*?

At sight, give the sums: —

A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*
$\frac{1}{8}$	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{1}{7}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{5}{8}$	$\frac{7}{8}$	$\frac{2}{7}$	$\frac{5}{6}$	$\frac{3}{7}$
$\frac{1}{16}$	$\frac{1}{9}$	$\frac{1}{6}$	$\frac{1}{14}$	$\frac{1}{15}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{14}$	$\frac{7}{9}$	$\frac{5}{14}$
$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{8}$	$\frac{1}{21}$	$\frac{1}{10}$	$\frac{5}{12}$	$\frac{1}{16}$	$\frac{1}{24}$	$\frac{3}{28}$	$\frac{1}{18}$	$\frac{1}{28}$

L	*M*	*N*	*O*	*P*	*Q*	*R*	*S*	*T*	*U*	*V*	*W*
$\frac{7}{15}$	$\frac{7}{18}$	$\frac{31}{33}$	$\frac{7}{24}$	$\frac{7}{40}$	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{3}{5}$	$\frac{1}{2}$	$\frac{1}{10}$	$\frac{7}{10}$	$\frac{5}{6}$
$\frac{11}{30}$	$\frac{17}{36}$	$\frac{29}{66}$	$\frac{23}{36}$	$\frac{9}{50}$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{1}{12}$	$\frac{5}{12}$	$\frac{3}{7}$
$\frac{3}{10}$	$\frac{5}{12}$	$\frac{3}{11}$	$\frac{1}{72}$	$\frac{61}{80}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{1}{15}$	$\frac{8}{15}$	$\frac{7}{8}$

DRILL TABLE

At sight, add the two adjacent numbers in any two columns: —

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1.	$\frac{1}{2}$	$\frac{4}{5}$	$\frac{3}{16}$	$\frac{5}{18}$	$4\frac{1}{3}$	$12\frac{1}{2}$	$19\frac{7}{8}$	$341\frac{4}{9}$
2.	$\frac{1}{3}$	$\frac{5}{8}$	$\frac{5}{18}$	$\frac{9}{20}$	$6\frac{3}{4}$	$16\frac{2}{3}$	$19\frac{5}{12}$	$482\frac{5}{10}$
3.	$\frac{1}{4}$	$\frac{3}{7}$	$\frac{1}{20}$	$\frac{2}{3}$	$8\frac{5}{6}$	$18\frac{3}{4}$	$16\frac{1}{2}$	$386\frac{5}{12}$
4.	$\frac{1}{5}$	$\frac{8}{15}$	$\frac{4}{25}$	$\frac{5}{6}$	$7\frac{5}{12}$	$31\frac{1}{4}$	$24\frac{1}{8}$	$521\frac{3}{4}$
5.	$\frac{1}{6}$	$\frac{7}{8}$	$\frac{6}{7}$	$\frac{8}{9}$	$8\frac{5}{9}$	$33\frac{1}{3}$	$24\frac{3}{4}$	$287\frac{1}{6}$
6.	$\frac{1}{8}$	$\frac{7}{12}$	$\frac{4}{9}$	$\frac{7}{16}$	$9\frac{11}{18}$	$37\frac{1}{2}$	$41\frac{2}{3}$	$272\frac{1}{4}$
7.	$\frac{1}{9}$	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{14}{15}$	$6\frac{7}{8}$	$43\frac{3}{4}$	$36\frac{11}{12}$	$316\frac{7}{16}$
8.	$\frac{1}{10}$	$\frac{3}{25}$	$\frac{9}{10}$	$\frac{4}{9}$	$7\frac{7}{10}$	$56\frac{1}{4}$	$45\frac{4}{5}$	$382\frac{7}{8}$
9.	$\frac{1}{12}$	$\frac{11}{16}$	$\frac{3}{15}$	$\frac{7}{9}$	$10\frac{2}{5}$	$62\frac{1}{2}$	$48\frac{9}{16}$	$681\frac{2}{3}$
10.	$\frac{4}{15}$	$\frac{3}{5}$	$\frac{4}{25}$	$\frac{3}{8}$	$11\frac{13}{15}$	$66\frac{2}{3}$	$52\frac{3}{4}$	$218\frac{4}{5}$

At sight, give the difference between any two adjacent numbers in the above table.

Sight Work in Multiplication

At sight, give the products of:—

A	*B*	*C*	*D*	*E*	*F*	*G*
$\frac{1}{2} \times \frac{1}{3}$	$\frac{1}{2} \times \frac{2}{3}$	$\frac{1}{5} \times \frac{4}{7}$	$\frac{3}{4} \times \frac{7}{8}$	$\frac{5}{14} \times \frac{7}{9}$	$\frac{24}{25} \times \frac{5}{8}$	$\frac{3}{7} \times \frac{21}{24}$
$\frac{1}{3} \times \frac{1}{4}$	$\frac{2}{3} \times \frac{3}{4}$	$\frac{3}{8} \times \frac{2}{3}$	$\frac{3}{5} \times \frac{5}{9}$	$\frac{8}{16} \times \frac{8}{11}$	$\frac{14}{15} \times \frac{5}{3}$	$\frac{5}{6} \times \frac{18}{25}$
$\frac{1}{2} \times \frac{1}{4}$	$\frac{3}{4} \times \frac{5}{6}$	$\frac{1}{4} \times \frac{5}{8}$	$\frac{6}{7} \times \frac{3}{4}$	$\frac{7}{8} \times \frac{16}{21}$	$\frac{16}{17} \times \frac{11}{32}$	$\frac{19}{21} \times \frac{63}{76}$
$\frac{1}{3} \times \frac{1}{5}$	$\frac{2}{3} \times \frac{7}{8}$	$\frac{5}{6} \times \frac{7}{8}$	$\frac{3}{4} \times \frac{7}{9}$	$\frac{3}{5} \times \frac{10}{17}$	$\frac{9}{10} \times \frac{5}{6}$	$\frac{34}{85} \times \frac{105}{136}$
$\frac{1}{4} \times \frac{1}{5}$	$\frac{3}{4} \times \frac{5}{9}$	$\frac{8}{10} \times \frac{5}{8}$	$\frac{2}{9} \times \frac{7}{11}$	$\frac{2}{3} \times \frac{6}{11}$	$\frac{7}{8} \times \frac{16}{25}$	$\frac{53}{65} \times \frac{130}{159}$
$\frac{1}{2} \times \frac{4}{5}$	$\frac{3}{5} \times \frac{5}{6}$	$\frac{3}{4} \times \frac{12}{16}$	$\frac{3}{4} \times \frac{11}{12}$	$\frac{15}{16} \times \frac{2}{3}$	$\frac{5}{6} \times \frac{18}{23}$	$\frac{17}{18} \times \frac{54}{51}$

Written Work in Multiplication

Copy and find the products of:—

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
425	165	368	247	397	246	263
$12\frac{1}{2}$	$24\frac{1}{4}$	$37\frac{1}{5}$	$28\frac{1}{6}$	$38\frac{1}{8}$	$35\frac{1}{9}$	$38\frac{1}{7}$
8.	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**
268	174	984	374	572	624	186
$29\frac{2}{3}$	$36\frac{3}{4}$	$47\frac{2}{5}$	$76\frac{5}{6}$	$19\frac{7}{8}$	$93\frac{5}{7}$	$26\frac{8}{9}$
15.	**16.**	**17.**	**18.**	**19.**	**20.**	**21.**
$138\frac{3}{4}$	$753\frac{2}{3}$	$963\frac{4}{7}$	$375\frac{5}{9}$	$573\frac{7}{8}$	$575\frac{5}{7}$	$365\frac{2}{3}$
16	24	28	72	64	49	48
22.	**23.**	**24.**	**25.**	**26.**	**27.**	**28.**
$246\frac{2}{3}$	$598\frac{5}{7}$	$613\frac{5}{9}$	$378\frac{3}{7}$	$783\frac{7}{8}$	$963\frac{5}{6}$	$843\frac{7}{8}$
17	24	24	46	25	39	28

Multiplication shortened by Cancellation — Written Work

Rewrite, cancel common factors, and simplify: —

1. $\frac{21}{32} \times \frac{4}{9} \times \frac{2}{3} \times \frac{6}{7} \times \frac{32}{54}$.
2. $\frac{1}{5} \times \frac{20}{29} \times \frac{13}{17} \times \frac{58}{91} \times \frac{51}{60}$.
3. $\frac{3}{4} \times \frac{19}{20} \times \frac{12}{35} \times \frac{28}{38} \times \frac{49}{63}$.
4. $\frac{21}{38} \times \frac{19}{35} \times \frac{2}{3} \times \frac{57}{84} \times \frac{24}{49}$.
5. $\frac{5}{11} \times \frac{13}{15} \times \frac{22}{39} \times \frac{21}{24} \times \frac{121}{132}$.
6. $\frac{3}{4} \times \frac{5}{7} \times \frac{16}{27} \times \frac{21}{35} \times \frac{16}{17}$.
7. $\frac{2}{3} \times \frac{7}{9} \times \frac{5}{6} \times \frac{9}{10} \times \frac{18}{35} \times \frac{20}{63}$.
8. $\frac{2}{7} \times \frac{5}{6} \times \frac{13}{17} \times \frac{21}{28} \times \frac{12}{35} \times \frac{34}{65}$.
9. $\frac{3}{8} \times \frac{5}{9} \times \frac{16}{27} \times \frac{18}{25} \times \frac{17}{19} \times \frac{38}{51}$.
10. $\frac{9}{10} \times \frac{20}{21} \times \frac{7}{36} \times \frac{4}{11} \times \frac{8}{17} \times \frac{51}{60}$.
11. $\frac{13}{21} \times \frac{35}{39}$.
12. $\frac{25}{36} \times \frac{24}{70}$.
13. $\frac{3}{22} \times \frac{55}{63}$.
14. $\frac{5}{13} \times \frac{65}{41}$.
15. $\frac{11}{12} \times \frac{96}{121}$.
16. $\frac{35}{64} \times \frac{72}{95}$.
17. $\frac{85}{96} \times \frac{42}{54}$.
18. $8\frac{3}{4} \times 6\frac{3}{7}$.
19. $\frac{2}{3} \times 7\frac{1}{2}$.
20. $2\frac{2}{3} \times 7\frac{5}{16}$.
21. $4\frac{4}{5} \times 15\frac{5}{8}$.
22. $6\frac{5}{8} \times 246$.
23. $\frac{4}{7} \times \frac{3}{8} \times 3\frac{1}{2}$.
24. $2\frac{2}{3} \times 4\frac{1}{5} \times 7\frac{1}{233}$.
25. $\frac{3}{4} \times 1\frac{2}{7} \times \frac{7}{9}$.
26. $1\frac{2}{5} \times 5\frac{1}{7} \times 1\frac{2}{935}$.
27. $1\frac{3}{8} \times \frac{7}{11} \times 3\frac{1}{16}$.
28. $2\frac{5}{8} \times 4\frac{2}{7} \times 6\frac{3}{5}$.

Sight Work in Division

At sight, give the quotient: —

1. $\frac{4}{3} \div \frac{2}{3}$.
2. $\frac{5}{6} \div \frac{2}{6}$.
3. $\frac{7}{8} \div \frac{3}{8}$.
4. $\frac{9}{11} \div \frac{8}{11}$.
5. $\frac{8}{9} \div \frac{5}{9}$.
6. $\frac{15}{16} \div \frac{3}{16}$.
7. $\frac{18}{11} \div \frac{2}{11}$.
8. $\frac{3}{4} \div \frac{1}{2}$.
9. $\frac{5}{8} \div \frac{1}{4}$.
10. $\frac{8}{9} \div \frac{1}{3}$.
11. $\frac{11}{6} \div \frac{2}{3}$.
12. $\frac{17}{9} \div \frac{2}{3}$.
13. $\frac{13}{10} \div \frac{3}{5}$.
14. $\frac{5}{6} \div \frac{5}{12}$.
15. $\frac{7}{8} \div \frac{3}{16}$.
16. $\frac{2}{3} \div \frac{5}{9}$.
17. $\frac{3}{4} \div \frac{5}{16}$.
18. $\frac{2}{3} \div \frac{3}{4}$.
19. $\frac{1}{2} \div \frac{2}{3}$.
20. $\frac{3}{4} \div \frac{2}{5}$.
21. $\frac{2}{5} \div \frac{2}{3}$.
22. $\frac{6}{7} \div \frac{2}{3}$.
23. $\frac{5}{7} \div \frac{3}{4}$.
24. $\frac{9}{12} \div \frac{15}{20}$.

Written Work in Division

1. $5\frac{2}{9} \div \frac{17}{30}$.
2. $17\frac{2}{3} \div 53$.
3. $13\frac{1}{4} \div 8\frac{1}{3}$.
4. $22\frac{2}{9} \div 33\frac{1}{3}$.
5. $16\frac{2}{3} \div 3\frac{1}{3}$.
6. $15\frac{1}{2} \div 4\frac{1}{5}$.
7. $13\frac{3}{4} \div 2\frac{1}{3}$.
8. $2\frac{5}{6} \div 7\frac{1}{3}$.
9. $6\frac{3}{4} \div 3$.
10. $18\frac{3}{4} \div 2\frac{1}{3}$.
11. $11\frac{2}{3} \div 3\frac{1}{2}$.
12. $12\frac{3}{4} \div 1\frac{1}{5}$.
13. $6\frac{7}{8} \div 1\frac{2}{3}$.
14. $14 \div 8\frac{4}{7}$.
15. $21\frac{1}{4} \div 3\frac{5}{8}$.
16. $184\frac{2}{3} \div 46\frac{1}{6}$.

CHAPTER III

DECIMALS

Fundamental Notions

1. What is a decimal fraction? 2. What is the use of the decimal point? 3. What effect upon a number when the point is moved to the right? 4. To the left?

Multiply the following by 10; *by* 100; *by* 1000. *Give the results at sight.*

1. 345.68.
2. 197.34.
3. 84.965.
4. 1754.6.
5. 18.462.
6. 396.62.
7. 86.54.
8. 0.342.
9. 1.568.

At sight, give the results:—

1. 1 ÷ 1.
2. 1 ÷ 0.1.
3. 1 ÷ 0.01.
4. 10 ÷ 0.1.
5. 10 ÷ 0.01.
6. 0.1 ÷ 1.
7. 0.1 ÷ 0.1.
8. 0.1 ÷ 0.01.
9. 0.1 ÷ 0.001.
10. 0.1 ÷ 10.
11. 0.1 ÷ 100.
12. 1 ÷ 10.
13. 1 ÷ 100.
14. 1 ÷ 1000.
15. 0.001 ÷ 100.
16. 0.0001 ÷ 0.1.
17. 100 ÷ 0.01.
18. 10 ÷ 1000.
19. 0.22 ÷ 10.
20. 2.2 ÷ 0.001.
21. 220 ÷ 1000.
22. 0.022 ÷ 100.
23. 2.2 ÷ 0.00001.
24. 2200 ÷ 0.0001.
25. 0.022 ÷ 11,000.
26. 2200 ÷ 0.00001.
27. 0.00001 ÷ 100.
28. 10,000 ÷ 0.0001.
29. 100 × 34.68.
30. 0.01 × 576.3.
31. 100 × 0.346.
32. 0.001 × 0.0456.
33. 0.001 × 4.34.
34. 0.1 × 3.463.
35. 1000 × 3.1416.
36. 100 × 342.6.
37. 0.01 × 0.5634.
38. 100 × 344.2.
39. 0.01 × 6.436.
40. 0.01 × 0.5638.
41. 100 × 0.0046.
42. 1000 × 0.003.
43. 0.0001 × 4.3.
44. 0.02 × 3.45.
45. 0.2 × 2.25.
46. 20 × 22.5.
47. 0.02 × 4.2.
48. 0.002 × 300.

Multiplying by Aliquot Parts

At sight, give the products:—

1. $3\frac{1}{3} \times 63.73$.
2. $2\frac{1}{2} \times 86.48$.
3. $16\frac{2}{3} \times 193.52$.
4. $16\frac{2}{3} \times 384.54$.
5. 25×36.978.
6. 25×32.847.
7. $33\frac{1}{3} \times 96.126$.
8. $33\frac{1}{3} \times 73.245$.
9. 25×9.368.
10. 25×73.46.
11. $12\frac{1}{2} \times 6.344$.
12. $12\frac{1}{2} \times 73.824$.
13. $6\frac{1}{4} \times 86.375$.
14. $16\frac{2}{3} \times 42.963$.
15. $33\frac{1}{3} \times 19.634$.
16. 25×263.45.
17. $33\frac{1}{3} \times 46.751$.
18. $16\frac{2}{3} \times 32.968$.
19. $12\frac{1}{2} \times 175.32$.
20. $12\frac{1}{2} \times 134.56$.
21. 25×643.96.
22. 125×34.69.
23. 125×28.34.
24. 125×36.82.

Special Fractions

Memorize the following table:—

$0.50 = \frac{1}{2}$
$0.25 = \frac{1}{4}$
$0.12\frac{1}{2} = \frac{1}{8}$
$0.06\frac{1}{4} = \frac{1}{16}$
$1.25 = 1\frac{1}{4}$
$0.33\frac{1}{3} = \frac{1}{3}$
$0.66\frac{2}{3} = \frac{2}{3}$
$0.16\frac{2}{3} = \frac{1}{6}$
$0.08\frac{1}{3} = \frac{1}{12}$
$0.37\frac{1}{2} = \frac{3}{8}$
$0.62\frac{1}{2} = \frac{5}{8}$
$0.87\frac{1}{2} = \frac{7}{8}$
$0.14\frac{2}{7} = \frac{1}{7}$
$0.11\frac{1}{9} = \frac{1}{9}$
$0.83\frac{1}{3} = \frac{5}{6}$

NOTE. There are other relations that are readily seen from these. Thus, $0.28\frac{4}{7} = \frac{2}{7}$; $0.56\frac{1}{4} = \frac{9}{16}$; $0.58\frac{1}{3} = \frac{7}{12}$; etc.

Give at sight:—

1. 28×0.25.
2. 0.75×84.
3. 32×1.25.
4. 96×0.75.
5. 12×2.25.
6. 16×1.75.
7. 24×2.50.
8. 36×1.25.
9. 14×2.50.
10. 3.5×42.
11. 1.25×64.
12. $24 \times 0.33\frac{1}{3}$.
13. $36 \times 1.33\frac{1}{3}$.
14. $18 \times 0.66\frac{2}{3}$.
15. $48 \times 1.66\frac{2}{3}$.

Give products at sight:—

16. 51 × 0.33⅓.
17. 12 × 3.50.
18. 54 × 0.16⅔.
19. 24 × 1.16⅔.
20. 0.12½ × 88.
21. 1.12½ × 24.
22. 72 × 0.16⅔.
23. 96 × 0.08⅓.
24. 48 × 1.08⅓.
25. 24 × 0.37½.
26. 16 × 1.37½.
27. 0.83⅓ × 36.
28. 24 × 0.83⅓.
29. 18 × 1.83⅓.
30. 126 × 1.33⅓.

Written Work in Multiplication and Division

NOTE. When necessary, carry the quotients to four figures.

1. 0.84 × 0.251.
2. 0.164 × 0.28.
3. 0.38 × 0.64.
4. 0.08 × 0.008.
5. 1.06 × 0.934.
6. 2.002 × 0.163.
7. 2.5 × 0.016.
8. 4.3 × 0.009.
9. 3.04 × 1.09.
10. 0.109 × 0.206.
11. 0.019 × 0.008.
12. 0.909 × 9.09.
13. 34.62 ÷ 32.4.
14. 7.68 ÷ 2.4.
15. 89.6 ÷ 0.42.
16. 0.782 ÷ 0.032.
17. 9.63 ÷ 0.25.
18. 10.6 ÷ 0.72.
19. 12.8 ÷ 4.2.
20. 0.873 ÷ 1.46.
21. 0.973 ÷ 2.61.
22. 0.8 ÷ 0.73.
23. 0.95 ÷ 0.012.
24. 0.84 ÷ 0.009.

Abridged Processes — Written Work

Ex. 1. Find the product of 34.265 by 3.1416 to the second decimal place.

ABRIDGED WORK

$$\begin{array}{r}
34.265 \\
3.1416 \\
\hline
102.795 \\
3.4265 \\
1.3706 \\
342 \\
205 \\
\hline
107.65
\end{array}$$

NOTE. Since the result is to be the nearest second decimal, four decimals are kept in the partial products in order to get accurately the number to "carry" to the column whose sum is desired. If great care is used in expressing the right-hand figure of each partial product, but one more place than the number wanted in the complete product is needed.

Find the products, approximated to tenths, in the following: —

1. 34.6 × 38.42.
2. 9.362 × 84.52.
3. 62.96 × 3.141.
4. 8.695 × 6.843.
5. 36.81 × 49.26.
6. 26.83 × 3.1416.
7. 879.6 × 1.732.
8. 89.07 × 1.414.
9. 32.61 × 4.208.
10. 396.2 × 16.84.

Ex. 2. Find the quotient of 26.843 divided by 3.1416, to the second decimal place.

Abridged Work

$$\begin{array}{r} 8.54 \\ 3.\cancel{1}\cancel{4}\cancel{1}\cancel{6})\,26.843 \\ \underline{25.13} \\ 1\ 71 \\ \underline{1\ 57} \\ 14 \\ \underline{13} \end{array}$$

Note. Multiplying a dividend by a number has the same effect upon the quotient as dividing the divisor by that number. Also, to "bring down" a figure is equivalent to multiplying the remainder by 10 and adding that number, and to "cut off" a figure from the divisor is equivalent to subtracting that number and dividing by 10. Then, evidently one may "cut off" a figure from the divisor instead of "bringing down" one from the dividend, without having much effect upon the quotient. (What is the difference?) In the work above, 16 was cut off before beginning the division, for it was at once evident that only three figures were required in the answer. The 4 of the divisor was cut off before the second division, then the 1 to its left before the third division.

Find the quotients, approximated to tenths, in the following: —

1. 96.285 ÷ 43.265.
2. 396.28 ÷ 3.1416.
3. 84.305 ÷ 9.6281.
4. 1.4260 ÷ 0.06345.
5. 32.465 ÷ 0.13462.
6. 3 ÷ 0.0562.
7. 8 ÷ 1.065.
8. 14 ÷ 3.246.
9. 256 ÷ 3.1416.
10. 85 ÷ 1.732.
11. 94.06 ÷ 1.728.
12. 107.65 ÷ 6.318.
13. 42.5 ÷ 16.75.
14. 100 ÷ 6250.
15. 7.5 ÷ 18.375.
16. 16 ÷ 0.7854.

CHAPTER IV

DENOMINATE NUMBERS

Add: —

(1)

yd.	ft.	in.
3	1	9
2	2	10
4	2	7

(2)

lb.	oz.
3	12
5	10
8	14

(3)

gal.	qt.	pt.
3	3	1
4	2	0
5	3	1

4. 3 ft., 6 in.; 5 ft., 10 in.; 9 ft., 8 in.; 10 ft., 7 in.; 8 ft., 6 in.

5. 6° 30′ 40″; 10° 28′ 42″; 12° 36′ 54″; 13° 45′ 48″; 4′ 53″.

6. 24 bu., 3 pk.; 16 bu., 2 pk.; 24 bu., 1 pk.; 35 bu., 3 pk.; 16 bu., 3 pk.

Subtract: —

(7)

gal.	qt.	pt.
25	2	0
18	3	1

(8)

rd.	yd.	ft.
84	3	1
56	4	2

(9)

bu.	pk.	qt.
16	1	2
10	3	5

10. How many years, months, and days since the Declaration of Independence, July 4, 1776?

11. What is your age in years, months, and days?

12. The longitude of Honolulu is 157° 51′ 36″ west, and that of New Orleans 90° west. Find the difference.

13. The longitude of one place is 87° 13′ 46″ east, and of another 37° 56′ 14″ west. Find the difference in their longitude.

Multiply: —

(14)		(15)		(16)		(17)	
gal.	qt.	bu.	pk.	hr.	min.	lb.	oz.
5	3	11	3	15	48	19	12
	7		9		8		9

18. How many bushels of apples in 12 bbl. averaging 2 bu., 3 pk. each?

19. How many bushels of potatoes in 35 bags of 2 bu., 3 pk. each?

Divide: —

(20)			(21)			(22)			
	bu.	pk.		mi.	rd.		wk.	da.	hr.
4)	102	3	5)	12	84	5)	9	6	20

23. Two places are 74° 16′ 58″ apart. What is their difference in time?

24. When it is noon at Greenwich, it is 6:30 A.M. in what longitude?

25. When it is noon at New York, what time is it at a place 35° 40″ east? At 35° 40″ west?

26. The difference in time between two places is 8 hr., 40 min., 30 sec. What is the difference in longitude?

Reduction to a lower denomination: —

27. Reduce 2 yd., 2 ft., 7 in. to in.

28. Reduce 3 lb., 10 oz. to oz.

29. Reduce 5 cu. ft., 120 cu. in. to cu. in.

30. Reduce 56° 57′ to min.

31. Reduce 9 sq. yd., 7 sq. ft. to sq. ft.

32. Reduce 2 da., 5 hr., 48 min. to min.

33–38. *Express the number in each of the exercises from* 21 *to* 26, *page* 23, *inclusive in terms of the highest denomination mentioned, using decimals* (3 *places*).

39. What part of a circle is an arc of 36° 30′?

40. What part of a circle is an arc of 48° 45′?

41. When one has gone $\frac{3}{5}$ of the distance around a circle, through how many degrees has he walked?

42. Through how many degrees, minutes, and seconds has one traveled in going around $\frac{5}{7}$ of a circle?

43. One leaves a city in longitude 74° 36′ west and travels directly west to a point whose longitude is 122° 48′. Through what part of the distance around the world does he travel?

44. How many rods 5 ft., 7 in. long can be cut from a rod 39 ft. long? How much waste?

45. A machinist cut 8 bars each 1 ft., 6 in. long, 6 bars each 2 ft., 4 in. long, and 3 bars each 3 ft., 2 in. long from a 40 ft. bar. How much is left if there has been a total waste of $3\frac{1}{2}$ in. in cutting?

THE METRIC SYSTEM

Oral Exercises

1. How many mm. in a m.? In a Km.?

2. How many cm. in a m.? In a Km.?

3. Reduce 25 Km. to m.

4. Reduce 0.03 m. to mm. **5.** Reduce 0.37 Km. to m.

6. How many m. in 1.22 Dm.? In 2 Hm.? In .004 Km.?

7. How many cm. in 2.45 mm.? In 3 m.?

8. How many Hm. in 426.25 m.? How many Km.?

9. Reduce 4.25 sq. cm. to sq. m.; to sq. mm.

10. How many sq. cm. in 25 sq. m.? In 4286 sq. mm.?

11. How many sq. m. in 36,284 sq. mm.? In 12.34 sq. cm.?

12. Reduce 0.0286 sq. Km. to sq. Dm.; to sq. m.; to sq. dm.; to sq. cm.; to sq. mm.

13. How many cu. m. in 1 cu. cm.? In 1 cu. mm.?

14. How many cu. m. in 1 cu. Dm.? In 1 cu. Km.?

15. Reduce 26.814 cu. m. to cu. dm.; to cu. cm.; to cu. mm.

16. Reduce 5.123 cu. m. to cu. Dm.; to cu. cm.

17. How many a. in 5.268 Ha.? How many ca.? How many sq. m.?

18. How many cu. dm. in 12 steres? How many cu. Dm.?

19. How many ft. in 2.5 m.? In 327 cm.?

20. How many sq. in. in 100 sq. cm.? In 326.8 sq. mm.?

21. How many in. in 2.5 cm.? In 500 mm.?

22. How many mi. in 15 Km.?

23. The regulations of the United States government regarding foreign mail require that packages of merchandise sent through the mail may not exceed 30 cm. in length, 20 cm. in width, and 10 cm. in height. Express these dimensions in inches.

Explain the following reductions: —

24. 247.831 l. = 2.47831 Hl. = 24,783.1 Cl.

25. 1346.982 g. = 1.346982 Kg. = 134,698.2 cg.

26. Estimate the length of the room in m.

27. Estimate the weight of familiar objects in Kg.

28. Estimate in cm. lengths of lines drawn on the blackboard.

29. Give the dimensions of your books, slates, etc., in cm.

30. Give your weight and height by the metric system.

Written Exercises

1. In 847.2 Kg., how many grams? How many pounds?

2. Change 75 bushels to hektoliters.

3. How many square meters in a rectangle 18 ft. by 10 ft.?

4. An importer pays duty on 1200 m. of cloth. How many yards?

5. How many square rods in a square hektometer?

6. How many liters in a cubic meter?

7. An importer buys 250 l. of liquor at $0.75 a liter. He sells it for $3 a gallon. What does he gain or lose?

8. A rectangular stone is 1 m. long, 5 dm. wide, and 24 cm. thick. How many kilograms does it weigh, being eight times as heavy as water?

9. How many kilograms of flour in a barrel? (1 bbl. = 196 lb.)

10. Add 18.32 Km., 648 m., 94.8 Hm., 38.4 dm.

11. What will a stere of stone cost at $12 a cord?

12. How many hectares in a field 14 Hm. long and 40 Dm. wide? How many acres?

13. How many gallons in a cubic meter of water?

14. How many times is 16 dm. contained in 1.28 Km.?

15. If goods are bought at $2.35 per yard, at what price per meter must they be sold to gain 25%? (1 m. = 39.37 in.)

16. A hektoliter of fruit weighs 63 kilograms, and 32 liters of sirup can be obtained from it. How many kilograms of fruit will it take to make a hektoliter of sirup?

17. The distance between two places on a map is 12.5 centimeters. What is the actual distance between the places if the scale of the map is 1 to 60,000?

18. Coal weighing 2450 lb. weighs how many kilograms?

19. A tank 9 m. long, 8 m. wide, and $3\frac{1}{2}$ m. deep is filled with water. How many kiloliters does it contain? What is the weight of the water in kilograms? In metric tons?

20. The distance between two German cities is 320 Km. What is the distance in miles?

21. A Paris paper gives the speed of a train at 72.46 Km. per hour. What is the speed of the train in miles?

22. A Paris firm places with an American foundry an order for a cargo of steel bridge frames 17.128 m. in length. What is the required length in feet and inches, correct to a hundredth?

23. A Chicago picture dealer wishes to order from Paris a frame for a canvas 42 × 38 inches. Required the dimensions of the frame in centimeters, correct to a hundredth.

24. A bolt of imported silk is marked at 72.28 m. A dressmaker purchased it at $1.25 per yard. What is the amount of the bill?

25. If the distance between two cities is 120 mi., how far is it in kilometers?

26. Estimating that two of your ordinary steps make a meter, how far is your home, in meters, from the school?

27. A 200-liter cask of oil is purchased in Paris at 1.5 francs per liter, and retailed in New York at $1.95 per gallon. Allowing $12.95 for duties and transportation, what sum is gained?

28. An importer bought an invoice of 137.4 kilos of gum at 27.5 francs per kilo. After adding $28.75 for duties and transportation charges, what is the cost per pound in United States money? (1 franc = $0.193.)

29. The dome of the capitol at Washington is 287 ft., 6 in. high, surmounted by a statue of Liberty 19 ft., 6 in. high. What is the whole height in meters?

PART II

THE APPLICATIONS OF NUMBERS

CHAPTER V

PROBLEMS INVOLVING FRACTIONS

Oral Problems

1. If I pay 84 cents for $\frac{7}{8}$ of a yard of taffeta, how much is that a yard? How much can I buy for $10.08?

2. When $\frac{3}{4}$ of a yard of lace costs 60 cents, how much will $10\frac{1}{2}$ yards cost?

3. A certain rug is made of $\frac{1}{4}$ flax, $\frac{1}{3}$ hemp, and the rest jute. What part is jute? How much of each is used in making 600 pounds of rugs?

4. If a boy's wages are $10\frac{1}{2}$ cents an hour, how much will he receive for a week (6 days), working 8 hours a day?

5. A lady bought $18\frac{3}{4}$ yards of silk for a dress and had $2\frac{1}{8}$ yards left. How much did she use?

6. If it takes $1\frac{1}{2}$ yards of goods to make an apron, how many can be made from 9 yards?

7. If it takes $10\frac{3}{4}$ yards of braid for a suit, how much must a dressmaker buy for 8 such suits?

8. A man paid $9 for $\frac{3}{8}$ of a ton of hay. How much was that a ton? At that rate, what would $10\frac{3}{4}$ tons cost?

9. A man found that his coal, when the bin was $\frac{9}{10}$ full, cost him $126. At the end of the winter the bin was $\frac{1}{5}$ full. How much was the remaining coal worth?

10. If my horse eats $\frac{9}{10}$ of a ton of hay in 3 months, how much will he eat in a month?

11. I bought 8 bags of potatoes each containing $2\frac{3}{4}$ bushels. How many bushels did I buy? How much did they cost at 90 cents a bushel?

12. A merchant lost $\frac{1}{8}$ of the cost of a suit by selling it at $21. What did the suit cost him? How much did he lose?

13. A man uses 14 bushels of grain to sow 8 acres. At this rate, how much will he use in sowing a field of 40 acres?

14. A farmer raised 240 bushels of potatoes on $1\frac{1}{2}$ acres. How much was that per acre? At that rate, what will $5\frac{3}{4}$ acres yield?

15. A girl bought three remnants of ribbon containing $3\frac{1}{4}$ yards, $5\frac{3}{8}$ yards, and $6\frac{1}{2}$ yards, respectively, at an average price of 24 cents a yard. How much did she pay?

16. A dealer sold a suit for $36, gaining $\frac{1}{5}$ of what it cost him. How much did he make?

17. For $\frac{3}{4}$ of a shipment of goods a merchant received $\frac{6}{7}$ of the cost of the whole shipment. At this rate, how much more than the cost will he receive for the whole shipment?

18. A man owned $\frac{2}{3}$ of a certain business and sold $\frac{3}{4}$ of his share for $8500. At this rate, what was the whole business worth?

19. By selling a book for $3.50 a dealer gained $\frac{1}{6}$ of the cost. Find the gain and the cost.

20. $\frac{5}{6}$ of a sum of money is $245. What is $\frac{1}{2}$ of it? What is $\frac{1}{3}$ of it?

21. After drawing $\frac{1}{5}$ of his money in a bank, a boy finds that he has $28 left. How much had he at first?

22. A man sells $\frac{5}{16}$ of an acre of land for $45. At this rate, what is his farm of 150 acres worth?

23. After marking down goods $\frac{1}{3}$, an overcoat sold for $16. At what price was it first marked?

24. A merchant marks down goods $\frac{1}{3}$ and still makes $\frac{1}{5}$ of the cost. How were goods marked that cost $2?

25. A merchant sold goods for $1680, which was $\frac{1}{3}$ more than they cost. Find the gain.

26. If a boy can ride $42\frac{1}{2}$ miles in $8\frac{1}{2}$ hours, how long will it take him to ride 30 miles at the same rate?

27. After spending $\frac{1}{4}$ of his money for a suit and $\frac{1}{6}$ of it for an overcoat, a boy had $21 left. How much did each cost?

28. A cistern is $\frac{2}{3}$ full. After 740 gallons are drawn off, it is but $\frac{1}{6}$ full. How many gallons will the cistern hold?

29. If $\frac{1}{6}$ of the selling price of an article is gained, what part of the cost is gained?

30. How shall I mark a suit that cost $20, so that I may make $\frac{1}{5}$ of the cost when selling it at "a quarter off"?

Written Problems

1. A woman can buy a shirt waist for $3.20, or she can make it at the following cost for material: $2\frac{1}{2}$ yards india linen at 28 cents a yard, 4 yards of embroidery at 16 cents a yard, 6 buttons at 40 cents a dozen, and 10 cents' worth of thread. How much will she save by making the waist herself?

2. Henry had $2\frac{3}{4}$ acres of potatoes from which he gathered 330 bushels. How much will $5\frac{1}{4}$ acres yield?

3. A merchant receives a shipment of $1850 worth of cloth which he marks at a gain of $\frac{3}{5}$ of the cost, but reduces the marked price $\frac{1}{3}$ for a "bargain sale." How much does he make?

4. A dress skirt measures $3\frac{1}{2}$ yards around. It is to have a 10-inch ruffle (when finished) in which there is a $2\frac{1}{2}$-inch hem and 6 one-fourth inch tucks. Find the width and length of the piece taken for the ruffle. (In ruffling consider that $1\frac{1}{2}$ yards make 1 yard of finished ruffle.)

5. An engine in one week burned coal as follows: Mon. $8\frac{1}{4}$ tons; Tues. $9\frac{1}{8}$ tons; Wed. $8\frac{3}{4}$ tons; Thurs. $9\frac{1}{4}$ tons; Fri. $9\frac{1}{5}$ tons; and Sat. $8\frac{7}{8}$ tons. The cost was $4.65 per ton.

(*a*) How many tons were used in the six days?

(*b*) At this rate, how much will be used in a year of 300 days?

(*c*) What was the cost for the 6 days?

(*d*) If $\frac{1}{8}$ less could have been used by careful firing, what would have been the yearly saving?

6. A planer makes a cut $\frac{3}{4}$ inch wide. How many strokes will be required to plane a casting $15\frac{7}{16}$ inches wide? One $22\frac{3}{4}$ inches wide? One $10\frac{1}{8}$ inches wide?

7. The piston of an engine has an area of $183\frac{3}{4}$ square inches. The total pressure on the piston is 12,030 pounds. What is the pressure per square inch?

8. After spending $\frac{1}{4}$ of one's wages for clothing, $\frac{1}{3}$ for board, and $\frac{1}{8}$ for amusements, what part is left?

9. A bookkeeper spent $\frac{1}{6}$ of his salary for rent, $\frac{1}{20}$ for fuel, $\frac{1}{4}$ for food, and had $640 left for other purposes. What were his wages?

10. A car of wheat containing 93,730 pounds is found to be loaded $\frac{1}{12}$ over the permitted load. How many pounds must be removed?

11. A tender holds 30,280 pounds of water and 16,320 pounds of coal. How much lighter is it when $\frac{3}{5}$ of the water and $\frac{7}{12}$ of the coal have been used?

12. An engine uses $\frac{1}{15}$ of a ton of coal every mile. How far can she run on $8\frac{3}{5}$ tons of coal?

13. If a merchant marks his goods to be sold at a gain of $\frac{5}{8}$ of the cost and sells them at $\frac{1}{3}$ off from the marked price, what part of the cost does he make?

14. How much above cost must a merchant mark goods so that he will make $\frac{2}{5}$ of the cost after marking down the marked price $\frac{1}{4}$?

15. An overcoat costs $16. For how much must it be marked so that the merchant may deduct $\frac{1}{6}$ from the marked price and still make $\frac{1}{4}$ of the cost?

16. At 11$\frac{1}{4}$ cents a pound a bale of cotton was worth $55.80. How many pounds in the bale? What would it have been worth at 13$\frac{3}{8}$ cents a pound?

17. If jute costs 8$\frac{3}{5}$ cents per pound, spinning $\frac{7}{8}$ cent per pound, and twisting and finishing $\frac{5}{16}$ cent per pound, find the total cost of 1500 pounds of jute twine.

18. If a skirt requires 3$\frac{3}{4}$ yards of lawn at 28$\frac{1}{4}$ cents a yard, 4$\frac{1}{4}$ yards of embroidery at 22$\frac{1}{2}$ cents a yard, buttons, thread, etc., worth 16 cents, and the cost of labor is 48 cents each, at what price per dozen must a manufacturer mark them to make $\frac{1}{6}$ of the total cost?

19. A manufacturer gets $30 per dozen for lawn waists. This is a gain of $\frac{1}{5}$ of the cost. Find how much he paid for the making of a waist if the cost of material was as follows: 2$\frac{1}{2}$ yd. lawn at 25 ¢; 4$\frac{1}{4}$ yd. embroidery at 15 ¢; $\frac{1}{2}$ doz. buttons at 30 ¢ per dozen; thread, 5 ¢.

20. A farmer had 18 bales of wool (250 pounds each) from his flock of sheep. How many sheep must he have had if the fleeces averaged 6$\frac{1}{4}$ pounds each? How much was it worth at 28$\frac{3}{4}$ cents per pound? If wool loses $\frac{4}{7}$ in scouring, how much scoured wool will this make?

21. A planer makes a cut $\frac{3}{4}$ in. wide. How many strokes will be required to plane a casting 2 ft., 8 in. wide?

22. A piece of piping has an internal diameter of 3$\frac{1}{4}$ in. and an external diameter of 5$\frac{3}{8}$ in. How thick is the wall of the pipe?

23. Ten tons of flax are bought at $15\frac{1}{2}$ cents a pound. The loss in weight, in cleaning, and bleaching is $\frac{1}{5}$. If the cleaned flax sells for $22\frac{3}{4}$ cents per pound, how much is gained or lost?

24. Find the income from 10 acres of flax which yield an average of $\frac{7}{8}$ of a ton per acre, if $\frac{8}{15}$ of this is fiber worth $12\frac{1}{2}$ cents per pound and the remainder seed worth \$0.98 a bushel (56 lb.).

25. How many rivets each weighing 2 oz. can be made from a 12-ft. bar of iron weighing $\frac{2}{3}$ lb. to the foot?

26. One year Montana produced 30,820,000 pounds of wool. If this was $\frac{2}{17}$ of the total production of the United States that year, how much did all other states produce?

27. New Jersey has $\frac{3}{5}$ as many silk mills as all other states combined. If there are 300 mills in all the other states, how many has New Jersey? How many in all?

28. At an election 1300 votes are cast for two candidates. $\frac{4}{9}$ of the number cast for one equals $\frac{12}{25}$ of the number cast for the other. How many votes are cast for each?

29. If $\frac{5}{8}$ of a pound of tea costs \$0.50, how much will $16\frac{3}{4}$ pounds cost?

PROBLEMS INVOLVING DECIMALS

Oral

1. After spending 0.34 of my money, what part was left?

2. A merchant lost 0.12 of the cost of an overcoat. What part of the cost did he receive?

3. Express as decimals: —

$\frac{1}{2}$; $\frac{3}{4}$; $\frac{2}{5}$; $\frac{5}{8}$; $\frac{3}{5}$; $\frac{7}{8}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{5}{6}$.

4. Express as common fractions: —

0.5; 0.8; 0.16; 0.24; 0.25; 0.125; 0.84; 0.96.

5. After spending 0.28 of my money for rent, 0.32 of it for food, and 0.12 of it for heat and light, how much of it remained?

Written

1. Reduce to decimal parts of a foot: —

(*a*) 7 in.; (*b*) 8½ in.; (*c*) 10⅜ in.; (*d*) 1⅞ in.

2. When 19.4 tons of coal will run an engine 265.4 miles, how far will 14.6 tons run it?

3. Every pound of cotton gathered from the field yields 0.32 lb. of lint. How much lint will 8796 lb. yield?

4–9. Find the average to each depositor in savings banks in 1909: —

States	No. of Depositors	Amount Deposited	States	No. of Depositors	Amount Deposited
New Eng.	3,186,826	$1,261,949,227	Middle	902,676	$306,785,344
Eastern	3,837,650	1,780,646,935	Western	68,309	16,460,053
Southern	344,632	81,369,104	Pacific	491,770	266,195,044

10. When 3.4 ft. of an iron bar weighs 9.54 lb., how much will 17.8 ft. of the same bar weigh?

11. Add the squares of 56, 3.4, 0.18, and 6¼.

12. 7423.972 divided by a certain number gives a quotient of 12.13 and a remainder of 0.412. Find the divisor.

13. 64 cubic feet of water weigh 2 tons. How much will 345.76 cubic feet weigh?

14. How many degrees in 0.48 of a circumference?

15. If the grade on a section of railroad 348.8 yards long rises 3.75 ft., at the same rate, what is the rise on 1 mi.?

16. A boy walks ¼ mi. and 300 steps more, each measuring 2.2 ft. How far does he walk in feet?

17. If it costs 0.75 of a cent to transport a ton of freight a mile, how much will it cost at this rate to move a car containing 14500 lb. of wheat 106 miles?

CHAPTER VI

PERCENTAGE—GENERAL PROBLEMS

Oral

1. What does per cent mean?

2. What part of anything is 6% of it?

3. Express 20% as a decimal fraction; as a common fraction.

To be memorized: —

A TABLE OF EQUIVALENTS

$\frac{1}{2} = 50\%$
$\frac{1}{4} = 25\%$
$\frac{1}{8} = 12\frac{1}{2}\%$
$\frac{1}{3} = 33\frac{1}{3}\%$
$\frac{2}{3} = 66\frac{2}{3}\%$
$\frac{1}{6} = 16\frac{2}{3}\%$
$\frac{1}{5} = 20\%$
$\frac{2}{5} = 40\%$
$\frac{3}{5} = 60\%$
$\frac{4}{5} = 80\%$
$\frac{3}{4} = 75\%$
$\frac{3}{8} = 37\frac{1}{2}\%$

OTHER EQUIVALENTS LESS IMPORTANT ARE: —

$\frac{5}{6} = 83\frac{1}{3}\%$
$\frac{1}{7} = 14\frac{2}{7}\%$
$\frac{5}{8} = 62\frac{1}{2}\%$
$\frac{7}{8} = 87\frac{1}{2}\%$
$\frac{1}{12} = 8\frac{1}{3}\%$
$\frac{1}{16} = 6\frac{1}{4}\%$

4. A boy had \$80 in a bank and withdrew 20% of it. How much did he withdraw? How much had he left?

5. 10% of a debt of \$800 has been paid. How much is yet to be paid?

6. There were showers on 60% of the days in April. How many rainless days were there?

7. A girl missed 8 words out of 50. What per cent did she have right?

8. In an examination of 8 questions 2 are missed. What per cent is this?

9. Some American hemp loses 40% when manufactured into twine. How much twine will a ton of hemp make?

10. With some Italian hemp the loss is 20%. How much twine can be made from $2\frac{1}{2}$ tons of hemp?

11. After scouring 600 pounds of wool, it weighed but 200 pounds. What per cent was lost?

12. Another lot of 1000 pounds of wool weighed 450 pounds when scoured. What per cent was lost?

13. A boy deposited $80 in the bank last year and $100 this year. What was the per cent of increase? How much must he deposit next year to have the same per cent of increase?

14. The flooring for a hall costs $250 and the labor to lay and dress it will add 60% more. Find the total cost.

15. My rent is $720 a year. This is 10% of the value of the property. What is the value of the property?

16. My house cost $8000. For how much a year must I rent it to get 12% of its value?

17. A grocer pays $3 a barrel for apples, and sells them at a gain of 40%. How much does he get a barrel?

18. Sidney paid $24 for a bicycle, and, after using it two months, sold it at a loss of 20%. How much did he get for it?

19. A merchant retailed shoes at $4.90, for which he paid $3.50. What per cent did he gain?

20. A farmer raised 840 bushels of potatoes, but 20% of them were damaged by frost. How many were undamaged?

21. I bought oranges at the rate of 3 for 4¢ and sold them at the rate of 2 for 3¢. What was my rate of gain?

22. How many eggs in a basket if 12 are bad and 96% are good?

23. I sold a chair for $16 and gained $33\frac{1}{3}$%. What per cent should I have gained if I had sold it for $15?

Written Problems

1. After a man lost 40% of his money in one speculation and 10% of the remainder in another, he had $4590 left. How much had he at first?

2. Property insured for 80% of its value was entirely destroyed by fire. If the loss to the owner was $3300, not including the premium, what was the value of the property?

3. A farmer is paid 28 cents a pound for the butter fat in milk. What is his daily income from 12 cows that average 22 pounds of milk a day that tests 3.8% butter fat?

4. If the wages of a certain class of workmen are to be raised 15% from their present scale, which is $1.80 per day, what will the wages be under the new scale? How much more will the increase give a man who works 285 days?

5. If it costs the company $28.75 for the labor and $29.25 for the material to manufacture a certain piece of machinery, and 40% of the cost of the labor is added to the cost of the article to cover general expenses, what selling price must the company name in order to earn a profit of 15% on the total cost of the article?

6. If the cost of productive labor for one week in a certain department is $1728 and the cost of operating the department for that time is $576, what percentage must be added to the cost of labor on each article produced in order to meet the total expense of manufacture?

7. The tariff act of 1909 places a duty of 40% *ad valorem* upon kitchen utensils. Find the duty and total cost of a bill amounting to $846.50.

8. At a duty of $2.25 per dozen, and 35% *ad valorem*, what is the total cost of 675 doz. cotton shirts, invoice price $3.50 per dozen?

9. I bought a bill of glassware for $756. I lost 10% by breakage. At what per cent above cost shall I sell the remainder to make 33⅓% upon the whole?

10. The material for a concrete walk costs $58.60. The labor costs 125% of the material. At what price shall a contractor take the job to make 20% of the total cost of material and labor?

11. The number of "board feet" in a hard-wood flooring exceeds the area of the floor by 33⅓%. The labor of laying and dressing is 150% of the cost of lumber. Find the total cost for a floor 20 feet by 24 feet at $76 per thousand.

12. Labor adds 75% to the cost of producing a certain article, and the profit is 20% of the total cost. For what does a manufacturer sell an article, the material for which costs $8.45?

Oral Problems

By inspection, find the loss or gain: —

	Cost	Rate of Loss or Gain	Loss or Gain		Cost	Rate of Loss or Gain	Loss or Gain
1.	$3000	20%		**13.**	$8400	8⅓%	
2.	$6500	40%		**14.**	$4800	6¼%	
3.	$8200	10%		**15.**	$2800	2½%	
4.	$9600	12½%		**16.**	$1600	15%	
5.	$1250	30%		**17.**	$9600	25%	
6.	$1800	16⅔%		**18.**	$3500	$14\frac{2}{7}$%	
7.	$3690	33⅓%		**19.**	$4200	16⅔%	
8.	$2400	66⅔%		**20.**	$10,800	11⅑%	
9.	$3200	12½%		**21.**	$6500	50%	
10.	$2400	37½%		**22.**	$7800	20%	
11.	$3200	62½%		**23.**	$1800	25%	
12.	$2700	66⅔%		**24.**	$4200	16⅔%	

1. A merchant bought a suit for $12, and sold it at a gain of 30%. How much did he gain? For how much did he sell it?

2. A dealer gained $3 upon goods that cost him $15. His gain was what part of the cost? What per cent of it?

3. A book cost the dealer $2, and he sold it at a gain of 40%. How much did he gain? For how much did he sell it?

4. If a dealer buys a book for $3 and sells it for $4.20, how much does he gain? What part of the cost is this? What per cent of it?

5. By selling a suit for $24 a dealer made $8. What did the suit cost? The gain was what part of the cost? What per cent of it?

6. A table marked to sell for $45 was marked down 20% and then sold. For how much was it sold?

7. A house and lot that cost $8000 were sold for $10,000. What per cent was gained?

8. A man sold a house and lot for $6000, which was $1000 more than it cost him. What per cent did he make?

By inspection, find the rate of loss or gain: —

	COST	LOSS OR GAIN	RATE		COST	LOSS OR GAIN	RATE
1.	$10,000	$1000		**11.**	$9000	$4500	
2.	$1500	$500		**12.**	$2800	$400	
3.	$2400	$600		**13.**	$6400	$800	
4.	$1500	$7500		**14.**	$7200	$800	
5.	$1200	$600		**15.**	$6300	$900	
6.	$3600	$600		**16.**	$7500	$2500	
7.	$5000	$6000		**17.**	$7500	$3750	
8.	$5000	$7500		**18.**	$9000	$1500	
9.	$9600	$1600		**19.**	$8000	$2000	
10.	$6000	$1500		**20.**	$1200	$300	

9. By selling a stock of goods for $8000 a man lost $2000. What per cent did he lose?

10. If an article sells for 7/6 of the cost, what part of the cost is gained? What per cent is gained?

11. A man gets back the cost of his stock of goods by selling ¾ of them. At this rate, how much more than cost will he get for all? What per cent of gain is this?

12. When for ⅔ of a bill of goods a merchant receives the cost of ⅘ of them, what per cent does he make?

13. When a grocer gets the cost of 25 pounds of sugar for but 20 pounds, what per cent is he making?

14. If I lose 20% when selling an article, what per cent of the cost do I receive for it? If I gain 25% from the sale of an article, what per cent of the cost do I get for it?

15. A merchant lost 20% when selling an overcoat for $16. How much did it cost him?

16. A dress sold for $36. This was a gain of 20% of the cost. How much did it cost?

Written Problems

1. A piano costing $360 and selling for $580 yields what rate of gain?

2. A traveling salesman sold $75,500 worth of goods during a certain year. He received 7½ % of his sales for his services. What did he earn?

3. A salesman earned $4250 one year when he received but 6¼ % of his total sales. What were his total sales that year?

4. A merchant's sales for the year amounted to $75,000. His average gain was 12½ % of the sales. If clerk hire was $2400 and sundries $1250, what was the net gain? What per cent of the cost was the net gain?

5. A merchant bought coal at $6.25 per ton and sold it at $7.50 per ton. What was his rate of gain?

6. A man bought a quarter section (160 acres) of government land at $2.50 per acre. He sold ¾ of it at $8.50 per acre and the remainder at $10 per acre. The selling price was what per cent of advance over the first cost?

7. At the end of the year, a merchant found that his net profit was $5000. His expenses were: rent $720, clerk hire $1500, advertising $250, and sundry items $650. If the average gross profit of his sales was 16⅔ % of the selling price, find the sales for the year.

8. A grocer bought 2000 bushels of potatoes at 45 cents. ¾ of them were sold at a gain of 20 %, and the remainder at a loss of 11⅑ %. Find the net rate of gain.

9. A merchant bought 400 barrels of apples at $1.75 per barrel. He sold ¾ of them at $2.50, ⅛ of them at $2.75, and the remainder at $1.50. Find the net rate of gain.

10. After paying rent $600, clerk hire $2100, lighting and heating $320, and sundries $340, a man had a net profit of $3900 from his business. If his sales for the year were $64,000, find the average gross gain per cent upon the selling price of the goods. Find the net gain per cent upon the cost of the goods.

11. A real estate agent sold a farm of 145 acres at $120 per acre, and the stock and utensils for $3426. For his work he received 2 % of the price of the farm and 3 % of the price of the utensils. How much did he earn in all?

12. During the year, a merchant's sales amounted to $24,650. The average gain was 20 % of the sales. His rent was $480, clerk hire $1800, and sundries $540. The net gain was what per cent of the cost of the goods?

13. A dealer bought 25 boxes of oranges of 144 each at $3.50 per box. In all, he found 120 decayed ones. At what price per dozen must he sell the remainder to gain 25 % of the total cost?

14. A grocer bought 250 pounds of raw coffee bean at $14\frac{1}{4}$ cents a pound. In roasting, it lost 25 % of its weight. He sold the roasted coffee at 22 cents a pound. How much did he make? What per cent of the cost did he make?

15. A merchant bought sugar at $4\frac{1}{2}$ cents. If the loss in drying out, down weights, etc., was 10 % of the amount bought, what per cent did he make by selling it at 6 cents?

16. A merchant bought coffee at 22 cents a pound and sold it for 35 cents. What per cent does he make if he loses 5 % in bad debts?

17. A merchant sold $1500 worth of goods one year at an average advance of $33\frac{1}{3}$ % of the cost, but lost 2 % from bad debts. Find his net rate of gain.

18. Which is better, to sell goods at a gain of $33\frac{1}{3}$ % and collect all, or to sell at a gain of 45 % and collect but 90 %?

Commercial Discount — Oral Problems

1. What will a bill of goods listed at $90 cost if the discount is 20 %?

2. Goods listed at $150 cost $120. What was the rate of discount?

3. A bill of $1600 was discounted at 30 %. What was the net price?

4. What is the rate of discount when a piano listed at $800 sells for $600?

5. By paying cash a merchant may save 5 %. How much is this on a bill of $2400?

DRILL TABLE

	List Price	Rate of Discount	Net Price		List Price	Rate of Discount	Net Price
1.	$ 40	25%		9.	$ 240	$8\frac{1}{3}\%$	
2.	$ 65	20%		10.	$ 640	$12\frac{1}{2}\%$	
3.	$150	$33\frac{1}{3}\%$		11.	$ 750	20%	
4.	$600	$16\frac{2}{3}\%$		12.	$ 800	40%	
5.	$960	$16\frac{2}{3}\%$		13.	$ 900	$11\frac{1}{9}\%$	
6.	$175	10%		14.	$ 420	$14\frac{2}{7}\%$	
7.	$450	$16\frac{2}{3}\%$		15.	$1200	$16\frac{2}{3}\%$	
8.	$960	$33\frac{1}{3}\%$		16.	$ 720	25%	

Commercial Discount — Written Problems

1. A bill of goods listed at $375 was sold at 22% off. Find the net price.

2. I got a discount of $294 from a bill of goods listed at $840. What was the rate of discount?

3. I bought goods that were listed at $1150 for $920. What rate of discount was this?

4. A bill of $1980 was discounted $16\frac{2}{3}\%$. Find the net cost.

5. During a single month a merchant received goods amounting to $10,486. His average discount for cash was $4\frac{1}{2}\%$. How much did he save by paying cash?

6. A dealer sold goods listed at $980 at a discount of $12\frac{1}{2}\%$ from the list price, and still made $16\frac{2}{3}\%$ on what they cost him. What discount did the dealer get from the list price?

7. I bought a bill of goods listed at $1650 at a discount of 40%. What discount can I give from the list price to make 30% of what the goods cost me?

8. I made $84 on a bill of goods. This was 16⅔ % of what they cost me. At what were they listed if I received a discount of 20 % from the list price?

9. In making an estimate on a heating system, the plumber's terms were as follows: a boiler listed at $240, discount 25 %; radiators $84.50, discount 35 %; fittings $37.50, discount 40 %; work and other expenses $150. Find the total cost.

10. A jobber sold a bill of goods for $66.30, which was 15 % less than the list price. The jobber got a discount of 25 % from the list price. How much did he make? What per cent did he make?

11. A dealer bought 3 wagons listed at $70 each, and 2 others listed at $92 each. He received a discount of 47½ % from the list price. What was the net invoice price? By paying cash he got a further discount of 5 % from the net invoice price. How much did he save by paying cash?

12. I bought 62 yards of Bigelow carpeting at $1.30; 1 set of parlor furniture, $285; 2 sets of chamber furniture at $125 and $140. I received a dealer's discount of 15 % and 10 %, and 2 % for cash. What was the amount of my bill?

DRILL TABLE

	List Price	Rate of Discount	Discount	Net Price		List Price	Rate of Discount	Discount	Net Price
1.	$ 465	20⅓%			**8.**	$ 950		$ 96	
2.	$ 970	33⅓%			**9.**	$1050		$175	
3.	$1640	40%			**10.**	$1260			$1050
4.	$1830	5%			**11.**	$ 940		$ 23.50	
5.	$1960	2½%			**12.**	$ 630			$ 598.50
6.	$3470	5%			**13.**	$ 126			$ 108
7.	$1698	16⅔%			**14.**			$236.25	$ 708.75

Successive Discounts — Oral Problems

1. A bill of goods quoted at $400 is sold at 25% and 10% off. What is the net cost?

2. After receiving a discount of 20% and 10%, goods cost me $144. At what were they listed?

TABLE I

By inspection, give the net price: —

	List Price	Discount	Net Price		List Price	Discount	Net Price
3.	$ 600	20%, 10%		**8.**	$2400	25%, 10%	
4.	$ 900	$33\frac{1}{3}$%, 10%		**9.**	$3600	$33\frac{1}{3}$%, $12\frac{1}{3}$%	
5.	$1000	40%, 15%		**10.**	$1600	25%, 5%	
6.	$1200	$16\frac{2}{3}$%, 20%		**11.**	$3500	$14\frac{2}{7}$%, 2%	
7.	$1800	$33\frac{1}{3}$%, 20%		**12.**	$6000	10%, 10%	

TABLE II

By inspection, give the list price: —

	Net Price	Discount	List Price		Net Price	Discount	List Price
13.	$ 630	30%, 10%		**18.**	$750	40%, $16\frac{2}{3}$%	
14.	$ 108	40%, 10%		**19.**	$210	$66\frac{2}{3}$%, 10%	
15.	$ 900	50%, 10%		**20.**	$960	60%, 20%	
16.	$1800	$33\frac{1}{3}$%, 10%		**21.**	$240	$33\frac{1}{3}$%, 10%	
17.	$ 210	$12\frac{1}{2}$%, 20%		**22.**	$240	25%, 20%	

By inspection, give the single discount equivalent to: —

23. 10% and 10%. **26.** 40% and 25%. **29.** $66\frac{2}{3}$% and 10%.
24. 20% and 10%. **27.** 40% and $33\frac{1}{3}$%. **30.** 20% and 25%.
25. $33\frac{1}{3}$% and 10%. **28.** 50% and 10%. **31.** 40% and 20%.

32. 60% and 20%.
33. 60% and 25%
34. 30% and 10%.
35. 40% and 16⅔%.
36. 20% and 12½%.
37. 40% and 15%.
38. 50% and 5%.
39. 50% and 25%.
40. 50% and 40%.
41. 60% and 12½%.
42. 60% and 25%.
43. 55% and 33⅓%.
44. 40% and 30%.
45. 25% and 33⅓%.
46. 36% and 12½%.
47. 52% and 8⅓%.
48. 28% and 16⅔%.
49. 35% and 20%.
50. 80% and 20%.
51. 90% and 10%.
52. 70% and 30%.
53. 60% and 40%.
54. 50% and 50%.
55. 66⅔% and 33⅓%.

Successive Discounts — Written Problems

1. A bill of hardware was listed at $96, 40% and 10% off. Find the net price.

2. Find the net cost of a bill of $85, 40% and 5% off.

3. Find the net cost of 8 doz. drip pans listed at $4.45 per dozen, and 15 coal hods listed at $2.10 per dozen; discounts, 60%, 10%, and 10%.

4. Find the net cost of 24 doz. basting spoons at $3 per dozen, and ¼ gross galvanized buckets at $58 per gross; discounts 75% and 10%.

5. A dealer received a bill of window glass listed at $730, but the discounts were 90% and 15%. Find the net cost.

6. A dealer received an invoice of hardware listed at $850. The discounts were 40% and 10%. Find the net cost.

7. A bill of chinaware listed at $736 had discounts of 66⅔% and 10%. Find the net price, including $8.36 for boxing, freight, and drayage.

8. One third of the gross amount of a bill of silverware amounting to $846 was discounted at 40%, 10%, and 10%, and the remainder at 40% and 15%. Find the net amount of the bill. If the dealer retails the entire bill at an average of 90% of the list price, what does he make? What per cent of the net cost is this?

9. A dealer receives a bill the gross amount of which is $334. The discounts are 40% and 10%. The freight, drayage, and sundry expenses amount to $12.50. If the dealer receives an average of 85% of the list price, what per cent does he make on the net cost?

10. If a dealer gets discounts of 40% and 15%, what discount can he give on the list price to make 30% on his investment?

11. A jobber sold a plate glass for $150, less discounts 50%, 30%, and 10%, and made a profit of 25% upon what it cost him. What did it cost the jobber?

12. A dealer received the following invoice of wagons: 3 listed at $79 each; 2 listed at $81 each; 4 listed at $103 each; and one listed at $85. The discounts were 40% and 5%. Find the net invoice. If a further discount of 5% for cash is given, what will he save by paying cash?

13. A dealer bought disk harrows listed at $18.50, at 35% and 10% off, and sold them through an agent at 10% off from the list price. The agent got 25% of the amount he received for the harrows. Find the net profit of both the dealer and the agent on each harrow.

14. Three salesmen, A, B, and C, offer me the same kind of goods at the same list price. A offers to discount 25% and 15%; B 20% and 20%; and C 15%, 15%, and 10%. With which will it be best for me to deal, and how much should I save from a list price of $200?

Problems in Billing Goods

1. Is the following bill correct? What will settle this bill before 5/13/'10?

PITTSBURG, PENN 5–3–'10.

G. H. Gilmore & Co., Rochester, N.Y.

To PITTSBURG PLATE GLASS COMPANY, Dr.

TERMS: 2% 10 days, net 60 days.

QUANTITY	SIZE	FORWARDED AT PURCHASER'S RISK		PRICE				TOTAL	
4 boxes	26×32	DAA	$6.65	26	60				
6 "	24×28	"	5.31	31	86				
10 "	12×16	"	1.26	12	60				
		Less 90%, 20%		71	06	5	69		
2 "	26×30	DAA	9.03	18	06				
2 "	27½×40	"	10.31	20	62				
		Less 90%, 15%		38	68	3	29	8	98

2. Make out a bill from the same firm and to the same parties for the following: Date, March 5, 1910.

8 – 10¾ × 16½ SAA, at $1.14; 5 – 21¼ × 26¾ DAA, at $5.27; 6 – 23¼ × 28 DAA, at $6.02; 3 – 19¼ × 23 DAA, at $4.30; 6 – 27¼ × 25¼ SAA, at $6.76. Discount 90 and 15%.

Make out a bill for the following: —

3. Butler Bros., Chicago, Ill., sold to E. M. Rose & Co., Jan. 3, 1911, the following: 240 yd. matting at 17½ cents; 360 yd. matting at 18 cents; 8 rugs at $3; 2 matting rugs at $0.78; 5 couch covers at $3.25; 6 pr. curtains at $1.50; 12 pr. curtains at $2.75. Terms: 1% in 20 days; net 40 days.

What will settle the bill before Jan. 23? What Feb. 8?

4. Complete the following bill:—

CHICAGO-KENOSHA HOSIERY CO.

MANUFACTURERS OF SEAMLESS AND FULL-FASHIONED HOSIERY

Sold to Messrs. J. R. Doe & Co., Decatur, Ill.

TERMS { 2 per cent 10 days.
Net 30 days.
July 15, 1911.

No. of Doz.	Description	Price		Totals
2½	Boys' Stockings	1.90		
1½	“ “	2.00		
7½	“ “	2.10		
4	“ “	2.25		

If Doe & Co. remit before July 25, what should be the amount of the remittance? What must they remit any time between July 25 and Aug. 15?

5. Bill from the same firm to A. L. Dickson & Son, Jan. 4/'11, the following: 3½ doz. pr. hose at $3.25; 7½ doz. pr. children's stockings at $1.80; 12½ doz. pr. men's half hose at $2.50; 8½ doz. pr. boys' stockings at $2.25. What will settle the bill within 10 days? What within 30 days?

6. Sidney Shepherd & Co., Buffalo, N.Y., sold to H. M. Murphy & Son, March 13, 1910, the following:—

¼ gro. pails at $39.60; $\frac{1}{12}$ gro. steamers at $28.80; $\frac{1}{12}$ gro. steamers at $32.40; all less 10%. Also ½ gro. pails at $31 net; 1½ doz. drip pans at $4.45 less 60, 10, and 10%; ¼ doz. bond boxes at $5.10 less 10%. Terms: 2% off 10 days; net 60 days.

What will settle the bill before March 23? What within 60 days?

7. Complete the following: —

INDIANAPOLIS, IND., July 6, 1911.

Mr. R. H. Brabb, Springfield, Mo.

Bought of HOLLWEG & REESE

IMPORTERS OF CHINA, GLASS, AND QUEENSWARE

TERMS: 60 days or 2% off 10 days.

6	Doz. 5274 Plates	$2.25	*	*		
6	" " Teas	2.50	*	*		
$\frac{7}{12}$	" " Coffee Cup Only	2.40	*	*		
6	" " Fruit	1.50	*	*		
2	" " Deep Coup. Soup	2.00	*	*		
1	Only " Covd. Dish	1.65	*	*		
3	" " Casseroles	1.65	*	*		
			*	*		
	Less 10%		*	*		
					*	*
2	Doz. 19783 H. & Co. Fruit	3.19	*	*		
2	Only " Baker	1.50	*	*		
2	" " Lobster Salad	1.69	*	*		
			*	*		
	Less 25%, 10%		*	*		
			*	*		
	Pkg.			50	*	*
					*	*

8. Syracuse Chilled Plow Co., sold to Mr. Dawson, Feb. 8/'10, the following: —

3 Jr. sulky plows at $43 each; 7 No. 443 foot plows at $16.50; 12 No. 402 foot plows at $13.50; 4 disk harrows at $27.75; and 3 sectional lever harrows at $9.75. Discount 35% and 5%. Terms: 4 months, or 5% discount for cash in 30 days. What will settle the bill in 30 days? In 4 months?

Discounting the Marked Price — Oral Problems

1. Goods costing $2.50 were marked to sell at a gain of 40%, but were sold at 25% less than marked. Find the gain.

2. Shoes costing $30 per dozen were marked to sell at a gain of 50%, but were sold for "a quarter off," that is, at a discount of 25% from the marked price. What was the gain or loss on each pair?

3. Boys' suits costing $60 per dozen were marked to sell at a gain of 40%, and sold at "a quarter off." What was gained?

4. An article costing $3.50 was marked at an advance of 20% and discounted 10%. Find the gain.

5. Goods marked to sell at 40% gain were discounted 10%. What per cent of the cost was gained?

Suggestion. The marked price was 140% of the cost. The discount was 14% of the cost. Then the selling price was 126% of the cost.

6. Goods marked to sell at 20% gain were sold at 10% off. What per cent was gained?

7. What is lost by marking at an advance of 50% and discounting 40%?

8. What is gained by marking at an advance of 40% and discounting 20%?

9. A merchant marked shoes to sell at a gain of 60%. What does he make on a pair marked at $4.80 when selling at "a quarter off"?

10. A merchant made $1.50 when selling an $18 overcoat at "a quarter off." At what per cent of profit had he marked it?

11. After marking down a suit 25%, a dealer asked $15 for it. Being unable to sell it at this price, he gave another discount of 15% (on the $15) and still made 75 cents. At what per cent above cost was it first marked?

12. What discount can a merchant give on the price of goods marked to gain 50 % in order to get the cost of his goods?

13. A dealer received an invoice of $3500 worth of goods which he marked 33⅓ % above cost. He then marked them down 10 % for "a bargain sale." What was his profit? What per cent of profit did he make?

DRILL TABLE

No.	Cost Price	Rate of Gain	Profit	Marked Price	Rate of Discount	Selling Price	Net Loss or Gain
1.	$ 3.50	20%			10%		
2.	$ 7.60	25%			12½%		
3.	$10.50	33⅓%			2½%		
4.	$ 3.60	33⅓%			10%		
5.	$ 9.60	16⅔%			5%		
6.	$16.40	20%			8%		
7.	$24.80	40%			25%		
8.	$16.50	45%			16⅔%		
9.	$17.20	50%			12½%		

No.	Marked Rate of Gain	Rate of Discount	Rate of Loss or Gain
10.	50%	20%	
11.	40%	10%	
12.	40%	16⅔%	
13.	50%	16⅔%	
14.	33⅓%	10%	
15.	20%	12½%	
16.	40%	12½%	
17.	50%	8%	
18.	60%	35%	
19.	30%	20%	
20.	50%	33⅓%	
21.	40%	25%	
22.	30%	25%	
23.	20%	8%	
24.	25%	16⅔%	
25.	33⅓%	20%	
26.	60%	40%	
27.	60%	25%	

Commission — Oral Problems

1. What is the yearly income of a salesman who sells $60,000 worth of goods at 7½% commission? If his expenses are $150 per month, what is his net income?

2. A salesman earned $3600 selling goods on a 6% commission. How much did he sell?

3. If $6500 was the yearly commission from $65,000 worth of goods, what was the rate?

4. A salesboy was offered his choice of the following: $8.50 a week; $5 a week and 1% of his sales; or 4% of his sales. He chose the last. His sales averaged $265 per week. How much a week better than $8.50 is this? How much is this for the year, if he worked 50 weeks?

DRILL TABLE

No.	Sales	Rate	Com.	No.	Sales	Rate	Com.
5.	$85000	4%		**10.**	$345000	2%	
6.	$75000	8⅓%		**11.**	$ 95000	12½%	
7.	$96000	6¼%		**12.**	$ 42000	5%	
8.	$24000	25%		**13.**	$ 65000	15%	
9.	$36000	20%		**14.**	$ 72000	8%	

15. An agent bought 500 barrels of apples for me at $1.20 per barrel. Find his commission at 3%. How much per barrel did it add to the cost?

16. My agent bought a car load (720 bu.) of potatoes for me at 40 cents a bushel, commission 2½%. What was his commission? How much per bushel did it add to the cost? If freight, drayage, and other expenses are 9 cents a bushel, for how much a bushel must I sell them to make 30%?

Commission — Written Problems

1. A commission merchant sent me $829 from the sale of 500 barrels of apples at $1.75, after paying $20 freight and $8.50 storage. What commission did he charge me? How much per barrel was this?

2. I shipped produce to a commission merchant which he sold as follows: 68 crates of strawberries at $2.56 per crate; 2340 bunches of radishes at 2¼ cents a bunch; and 15 baskets (18 pounds each) at 12 cents a pound. How much did I receive if I paid 5% commission?

3. A commission merchant sold a car load of melons (1450) at 48 cents each, on a 5% commission. How much commission did he get from the sale?

4. Complete the following account sales: —

NEW YORK HAY EXCHANGE ASSOCIATION

June 1, 1910.

Sold for account of M. Dawson

		Description	No. Bales	Weight (lb.)				
May	1	No. 1 timothy at $20	164	22,445	*	*		
"	7	" 3 " at $16	180	24,625	*	*		
"	7	" 1 clover at $16	170	23,440	*	*		
"	9	" 2 " at $14	160	21,435	*	*	**	*
		Freight $90.40. Drayage $16.50 Storage $45						
		Commission $1 per ton . . .					**	*
		Amount of draft					**	*

Note. A commission merchant who deals in hay, grain, and beans usually charges per car, ton, or bushel.

5. Mr. Mooreman paid the following prices for 3 car loads of hay: No. 1 baled timothy $14; No. 2 baled timothy $12; No. 1 clover $12. He shipped it to the Brooklyn Hay and Grain Co., who sold it as follows: 300 bales No. 1 timothy, 42,225 pounds at $20; 120 bales No. 2 timothy, 16,345 pounds at $18; 90 bales No. 1 clover, 13,440 pounds at $17. Commission $1 per ton. Freight and drayage $96.75. Storage $36. Find the net gain and the gain per cent.

6. A dealer paid $1.80 per bushel (60 lb.) for beans, put them in bags of 165 pounds each, and sold them per car load f.o.b. (free on board cars) at $2.25 per bushel, through a commission merchant. The bags cost $165 per 1000. The commission merchant's fee was 5 cents per bag. Find the net profit on a car load of 320 bags.

7. A dealer bought 3 car loads of wheat (3460 bu.), paying an average price of 82 cents. It was sold by a commission merchant for 86 cents (f.o.b.). Find the net gain, commission being $5 per car.

Note. Dairy and poultry products are usually sold on a 5% commission.

8. A commission merchant sells 1580 lb. of chickens at 8¼ cents a pound, and 56 cases of eggs (30 doz. each) at 18¾ cents a dozen. He charges 5% and deducts $7.25 for freight and other charges. How much does he remit?

9. Find the net proceeds and the net gain from the following sale: 120 cases of eggs (30 doz. each) at 26 cents, 730 eggs broken; 60 crates of spring chickens, averaging 90 lb. per crate, at 22 cents; and 40 tubs dairy butter, 80 lb. each, at 18 cents. Freight $86. Drayage $32. Storage $28. Commission 5%. The average price paid was eggs, 18 cents; chickens, 16 cents; butter, 16 cents.

Brokerage — Written Problems

1. A speculator buys 50,000 bu. of wheat, through a broker, for 86⅛ ct., and sells at 93¼ ct. What does he make, brokerage being ⅛ ct. per bushel for buying and for selling? What is the broker's fee for buying and selling?

2. If a speculator buys 1500 barrels of pork at $14.05 and sells it at $12.87½, what is his total loss, not including interest, brokerage being 2½ ct. per barrel for buying and the same for selling? What is the broker's total fee?

3. What will 3500 bales (500 lb. each) of cotton cost at 9.6 ct. per pound, brokerage 5 ct. per bale? What is the brokerage on buying and selling?

4. A speculator buys 2800 bales of cotton at 10.2 ct. and sells at 9.8 ct. What is the total loss, brokerage 5 ct. per bale for each transaction? What is the broker's total fee?

5. How much does one make by buying 4900 bales of cotton at 11.2 ct. and selling at 13.8 ct., brokerage 5 ct. per bale on each transaction?

Simple Interest — Oral Problems

1. If you borrow $100 and agree to pay 6 % of this amount for a year's use of it, how much is this? If you repay the one of whom you borrow at the end of 1 year, how much will you pay, including the *interest* paid for its use? How much if you repay in 6 months? How much if you repay in 1 yr., 6 mo.?

2. What will you pay for the use of $500 for one year at 5 %? What will the interest be for 1½ years?

3. If you loan a man $800 for 1 year at 6 %, how much should he pay you at the end of the year?

4. If you should loan a man a sum of money, what would you require of him as evidence of the loan and security for its repayment?

$ 350 New York,------June 10,------1910
-------Six months-------after date---I---promise to pay to
the order of---W. B. Howe
Three Hundred Fifty Dollars.
Value received. Interest 6 %. ------E. A. Thompson.------

5. What is the *face* of the above note? Of whom was the money borrowed? When? Who borrowed it? What rate does he agree to pay for the use of it? When does he agree to repay the amount borrowed? How much interest will then be due? How much must the borrower pay the one of whom he borrowed?

> *In the commercial world, 12 months of 30 days each, or 360 days, are considered a year.*

6. At 6 %, what part of any *principal* is the interest for 360 days? What part, then, is the interest for 60 days at 6 %?

> *$\frac{1}{100}$ of any principal is the interest of it at 6 % for 60 days.*

7. Give the interest at 6 % for 60 days of $650; of $1250; of $1575; of $2500; of $1760; of $34,000; of $8400; of $3865.

8. Give the interest at 6 % for 30 days of $800; of $960; of $720; of $1250; of $1680; of $3640; of $1245; of $6300; of $4500.

9. Give the interest at 6 % for 6 days of $8000; of $7500; of $16,000; of $35,600; of $28,400; of $57,600; of $84,600.

Give the interest at 6 % *of the following:* —

10. $600 for 90 days.
11. $750 for 120 days.
12. $1200 for 45 days.
13. $1600 for 15 days.
14. $360 for 20 days.
15. $810 for 20 days.
16. $1600 for 6 days.
17. $2400 for 10 days.
18. $3600 for 15 days.
19. $8400 for 75 days.
20. $2600 for 90 days.
21. $7200 for 100 days.
22. $960 for 110 days.
23. $3200 for 75 days.
24. $4200 for 70 days.
25. $2800 for 45 days.
26. $4800 for 50 days.
27. $1250 for 90 days.
28. $1840 for 75 days.
29. $1280 for 115 days.
30. $2240 for 115 days.

31. At 5½ %, what is the interest of $6000 for 1 year? For 2 years? For 6 months? For 3 months? For 4 months? For 1½ years?

32. At 5 %, what is the interest of $1200 for 1 year? For 1 month? For 6 months? For 3 months? For 1 year, 3 months? For 1 year, 9 months? For 2½ years?

33. At 4½ %, what is the yearly interest of $6000? Of $10,000? Of $8000? Of $12,000? Of $7000? Of $24,500?

At 5 %, *what is the interest of:* —

34. $500 for 6 mo.?
35. $300 for 8 mo.?
36. $250 for 1 yr.?
37. $150 for 2½ yr?

At 5½ %, *what is the interest of:* —

38. $800 for 1 yr., 6 mo.?
39. $200 for 2 yr., 6 mo.?
40. $300 for 2 yr., 8 mo.?
41. $400 for 2 yr., 3 mo.?
42. $800 for 1 yr., 9 mo.?
43. $700 for 4 yr.?

44. If a bank hires money at 3½ % and lends it at 5 %, what does it gain on a loan of $25,000 for 2 yr., 10 mo.?

Written Problems

1. At 5 %, what is the interest of $540 for 2 yr., 7 mo.?

SOLUTION

$$\frac{31}{12} \times \frac{5}{100} \times \$540, \text{ or}$$

$$\frac{31 \times 5 \times \$540}{12 \times 100} = \$69.75$$

EXPLANATION. 0.05 of $540 = the int. for 1 yr. Now 2 yr., 7 mo. = $\frac{31}{12}$ yr. Hence the total interest = $\frac{31}{12} \times \frac{5}{100} \times \$540$.

NOTE. This is called the *general method* of finding interest.

Find the interest and amount of:—

2. $5000 at 5 % for 1 yr., 3 mo.

3. $6040 at 4 % for 1 yr., 8 mo.

4. $7500 at 4½ % for 2 yr., 2 mo.

5. $9460 at 6 % for 6 mo., 12 da.

6. $1350 at 5 % for 8 mo., 20 da.

7. $3460 at 4½ % for 9 mo., 10 da.

8. $4860 for 90 da. at 4 %.

9. $6500 for 70 da. at 5 %.

10. $1400 for 110 da. at 4½ %.

11. $3050 for 86 da. at 6 %.

12. $5100 for 65 da. at 5 %.

13. $1950 for 72 da. at 4 %.

14. What is 10 months' interest of $784 at 6 %?

15. What is the interest of $478 for 3 yr., 4 mo. at 6 %?

16. Find 5 months' interest of $856 at 6 %.

17. Find 2 months' interest of $460 at 6 %.

18. One month's interest of $324 at 5½ %.

19. What is the interest of $1800 for 4 yr., 2 mo. at 4½ %?

20. What is the interest of $1297 for 1 mo. at 6 %?

21. Interest of $375 for 20 da. at 6 %?

22. 12 days' interest of $750 at 5½ %?

23. 5 days' interest of $1200 at 4 %?

24. 6 days' interest of $27,864 at 4½ % ?

25. 4 months' interest of $2500 at 6 % ?

26. 15 days' interest of $2800 at 5 % ?

27. 3 days' interest of $500 at 5½ % ?

28. Interest of $800 for 5 yr., 10 mo. at 6 % ?

29. 20 days' interest of $4678 at 6 % ?

30. 111 days' interest of $480 at 5½ % ?

31. Find the interest of $400 for 1 yr., 10 mo., 15 da. at 6 %.

32. What is the interest of $2000 for 4 yr., 7 mo., 12 da. at 5 % ?

Find the interest at 6 % of:—

33. $720 for 87 da.

$$\begin{array}{rllll}
\$\ 7.20 = & \text{int.} & \text{for} & 60 & \text{da.}\\
2.40 = & \text{``} & \text{``} & 20 & \text{``}\\
.60 = & \text{``} & \text{``} & 5 & \text{``}\\
.24 = & \text{``} & \text{``} & 2 & \text{``}\\
\hline
\$10.44 = & \text{``} & \text{``} & 87 & \text{``}
\end{array}$$

NOTE. This is called the bankers' or the 60-day method of computing interest.

At 5 %, find the interest of:—

44. $840 for 75 da.

$$\begin{array}{rllllll}
\$8.40 = & \text{int.} & \text{at} & 6\,\% & \text{for} & 60 & \text{da.}\\
2.10 = & \text{``} & \text{``} & \text{``} & \text{``} & 15 & \text{``}\\
\hline
6\overline{)10.50} = & \text{``} & \text{``} & \text{``} & \text{``} & 75 & \text{``}\\
1.75 = & \text{``} & \text{``} & 1\,\% & \text{``} & \text{``} & \text{``}\\
\hline
\$8.75 = & \text{``} & \text{``} & 5\,\% & \text{``} & \text{``} & \text{``}
\end{array}$$

45. $820 for 70 da.

46. $950 for 63 da.

47. $720 for 93 da.

34. $965 for 117 da.

35. $1050 for 96 da.

36. $1360 for 33 da.

37. $1540 for 54 da.

38. $1680 for 93 da.

39. $2750 for 63 da.

40. $742 for 72 da.

41. $960 for 84 da.

42. $1432 for 36 da.

43. $1520 for 108 da.

---

48. $875 for 72 da.

49. $970 for 85 da.

50. $450 for 20 da.

51. $120 for 50 da.

52. $830 for 45 da.

53. $650 for 45 da.

54. $810 for 75 da.

55. $960 for 70 da.

Bank Discount — Oral Problems

Montclair, N. J., Feb. 10, 1910

Ninety days *after date, I promise to pay to the*

order of R. W. Hemphill, Cashier $ 600

Six hundred *Dollars*

at Montclair Savings Bank, Montclair, N. J.

Value received. *Residence* 314 Elm St.

Due *Discount* J. L. Turner

NOTE. When borrowing at a bank the interest, called *bank discount*, is paid in advance, hence no rate is named in the note.

1. When is the above note due?

2. At 6 %, what is the discount?

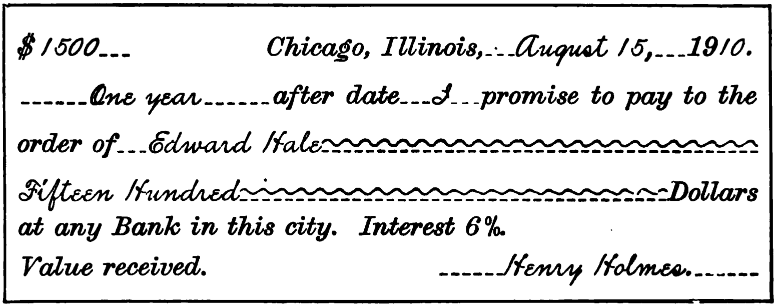
3. What are the proceeds?

4. Sometimes a note is not discounted the day it was dated. At 6 %, what would have been the discount on the above note 60 days before it was due? 30 days before it was due? 10 days before it was due?

5. A bank receives interest on the maturity value of the note at 6 %. What is the maturity value of a $1200 note to run 1 year at 5 %? What would the discount be 60 days before it is due? 30 days before it is due? 90 days before it is due? 6 days before it is due?

6. What is the maturity value of the following note?

7. What would a bank pay for the following note if bought 60 days before it is due (discount 6 %)? 90 days before it is due? 120 days before it is due? 45 days before it is due?



$1500 Chicago, Illinois, *August 15,* 19*10*.

One year after date *I* promise to pay to the order of *Edward Hale*

Fifteen Hundred Dollars

at any Bank in this city. Interest 6%.

Value received. *Henry Holmes.*

Discounting Notes — Written Problems

1. I sold a $400 non-interest-bearing note to the Merchants' Bank at 6% discount. It had 40 days to run. Find the proceeds.

2. What shall the Farmers' Bank pay for a note of $1000 without interest; the rate of discount is 5 per cent; the note matures 4 months from April 10, 1910, and is bought 25 days after date?

3. A 6% note for $1200 is payable in one year from date. What is it worth at maturity?

4. If this note is discounted 6 months before maturity at 6%, what are the proceeds?

5. What will it bring if sold to a bank when it is 3 months old?

6. What will a bank pay for it 98 days before maturity?

7. A bank bought a $600 note at date for $591. What was the rate of discount if the note had 60 days to run?

Find proceeds of notes under these conditions: —

	Face	Rate	Date of Note	Runs	Discounted
8.	$450	4	May 10	60 da.	28 da. after date.
9.	$720	5	Aug. 15	90 da.	48 da. before maturity.

10. Find the proceeds of a note for $958, dated Oct. 12, 1910, and having 45 days to run if discounted at date at $7\frac{1}{2}$ per cent.

11. A note of $600, dated May 3, 1908, interest 6%, to run 4 months, was discounted May 20 at 6%. Find the proceeds.

SOLUTION. Amount of the note when due, Sept. 3 = $612.
Interest on $612 at 6% for 106 days (from May 20 to Sept. 3) = $10.81.
Proceeds, or $612 − $10.81 = $601.19.

12. A note of $560 to run 3 months dated Aug. 4, 1908, bearing 5% interest, was discounted at 6% on Sept. 19. Find the discount and the proceeds.

13. A man sold his farm for $6500, taking a note due in 6 months, interest 5%. He at once sold the note to a bank, discount 6%. What did he get in cash for his farm?

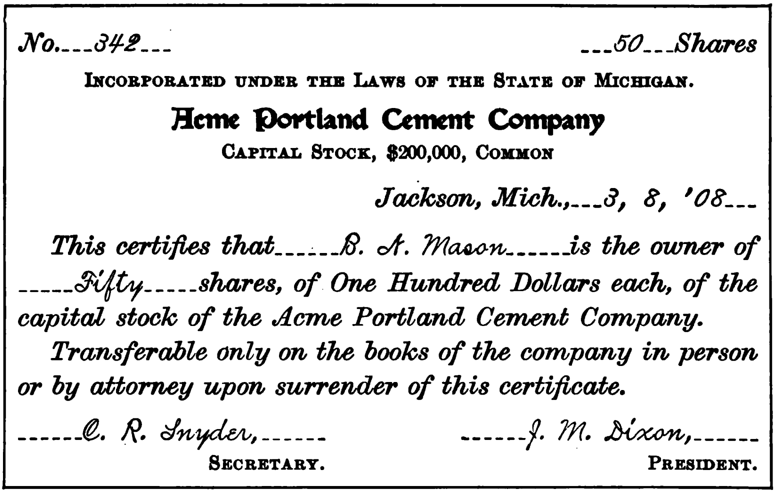
14. A certain wholesale house sells goods on 90 days' time, taking in payment a 90-day note without interest. What does the house get for an invoice of $820 discounted at 6% 5 days after the date of the note?

15. In order to get cash for goods, some firms allow a discount of 2% from the bill, if paid within 10 days. Others take a 60-day or 90-day note which they discount if they need cash. On a bill of $750, which is better for a firm, and how much, to allow a 2% discount or to discount a 60-day note at 6%? Which is better, 2% discount or to discount a 90-day note at 6%?

16. Some firms date their bills for certain kinds of goods two or three months ahead of the actual date of making out the invoice. A bill of wall paper amounting to $540 was billed Dec. 15, 1907, but dated March 1, 1908. If this bill is paid before March 1, a discount equal to 6% interest may be deducted. What will settle the bill Dec. 15? What will settle it Jan. 1, 1908? What Feb. 1?

Buying and Selling Stock — Oral Problems

A STOCK CERTIFICATE



No. 342 — 50 *Shares*

INCORPORATED UNDER THE LAWS OF THE STATE OF MICHIGAN.

Acme Portland Cement Company

CAPITAL STOCK, $200,000, COMMON

Jackson, Mich., 3, 8, '08

This certifies that B. A. Mason *is the owner of* Fifty *shares, of One Hundred Dollars each, of the capital stock of the Acme Portland Cement Company.*

Transferable only on the books of the company in person or by attorney upon surrender of this certificate.

C. R. Snyder, — SECRETARY.

J. M. Dixon, — PRESIDENT.

1. What is the name of the company issuing this stock certificate? From whom did the company get its right to carry on business? What is the entire capital of the company?

2. What is the par value of a share of Acme Portland Cement stock? Into how many shares of stock is the entire capital divided?

3. Who owns the above certificate? How many shares does he own? What is the par value of the certificate? How much will he receive if a 6 % dividend is declared?

4. If the market price of this stock was 50, it cost, without broker's fee, $50 per share. What would the 50 shares cost?

5. A corporation is formed with a capital of $50,000. If the shares are $100 each, how many are there? How many if $50 each? How many if $10 each?

6. Stock quoted at 135⅛, if bought through a broker, will cost how much per $ 100 share? What will 10 shares cost?

NOTE. Always consider brokerage ⅛ % of the par value.

7. When stock is quoted at 86⅜, what will a $ 100 share cost if bought through a broker? What will a $ 50 share cost? What will a $500 share cost?

8. How much money will I receive for each $ 100 share of stock sold through a broker at 163⅝? How much will I receive for 10 such shares? What will the broker get for his work?

9. If I buy stock at 143⅞ and sell it at 160⅛, both transactions through a broker, what will I make on each $100 share? How much will I make on 10 such shares?

10. If a corporation whose capital stock is $100,000 divides $6000 among its stockholders, what is the rate of dividend? What will a man receive who has $1000 of this stock?

11. $ 50,000 of the $ 250,000 capital stock of a company is preferred stock, paying 7 %. The remainder is common stock. If $19,500 is divided among the stockholders, what rate of dividend is declared upon the common stock? What does a holder of $ 2500 of the common stock receive?

12. If I own 20 $ 100 shares of stock in a corporation, and a 10 % dividend is declared, how much shall I receive?

13. If I own 10 $1000 shares of stock, and a 5 % quarterly dividend is declared, what do I receive each quarter? What do I receive in a year?

14. If I receive $400 as my 8 % dividend from a certain stock, how many $100 shares have I? What did they cost me, if bought through a broker, when quoted at 119⅞?

15. If my 4½ % dividend is $ 90, how many $100 shares have I? What can I realize by selling it through a broker, when quoted at 92⅛?

16. If I buy stock quoted at 199⅞, through a broker, and receive a 20 % annual dividend, what per cent of my investment is this? How much better is this investment than money loaned at 6 % interest?

17. When stock bought through a broker at 49⅞ pays a 4 % annual dividend, to what rate of interest is it equivalent?

18. What can I afford to pay for stock paying a 12 % annual dividend to receive 6 % on my investment? If I can afford to pay but $200 for a $100-share, at what *market* quotation must I buy through a broker to make this?

19. If my 5 % quarterly dividend on some stock is $250, how many $100 shares have I?

20. If I buy stock at 119⅞, through a broker, receive a 15 % dividend, and sell in one year for 125⅛, through a broker, how much have I invested per share, and what is my gain per cent?

21. What does one really lose, besides the interest on his money, by buying at 149⅞, and selling at 80⅛, after receiving 5 annual 12 % dividends? If money is worth 5 % interest, what is the total loss? Consider brokerage.

22. My broker, after deducting his brokerage of ⅛ %, remitted $7412.50 from a sale of 100 shares of stock. At what price did he sell the stock?

23. My broker bought 20 shares of stock for me. The total cost, including his commission, was $1640. What was the market price of the stock?

Stocks — Written Problems

1. What is the value of 35 shares of North Western stock at 43½ % above par?

2. What would be the value of the same stock if sold at the same rate below par?

3. I receive a stock dividend of $1728. This is a 9 % dividend. How much of the stock do I own?

4. The Atlantic Steamship Company is capitalized at $8,000,000. The receipts for the year are $16,400,000. The expenses are $14,800,000. $600,000 is put into a reserve fund, and the remainder distributed as a dividend. What rate per cent of dividend was declared?

5. How many hundred-dollar shares of mining stock can be bought at 118 for $3750, and what sum will remain?

6. I receive $2565 for stock sold at 107. How many hundred-dollar shares were sold, allowing ⅛ brokerage?

7. My broker paid me $8595, which he had received for Old Colony Railroad stock sold for me at ⅛ brokerage. How many shares did he sell at 215?

8. I spent $7500 for stock at 50 % above par. What would be received for the stock if sold at 3 % below par?

9. In the New York stock market 50,000 shares of railroad stock were bought at a premium of 22⅞, and sold the next day at a premium of 26¾. The brokerage in each case being ⅛, required the profit of the seller.

10. Mining stock yields me $1400 in 3½ % dividends, payable quarterly. How many 50-dollar shares do I own?

11. A man bought 40 shares of L. & N. stock at 156½, and received an annual dividend of 10 %. What was the total amount of the investment? What was the annual dividend? To what rate of interest is it equivalent?

12. On May 13, 1909, a man bought 30 shares of Cent. of N. J. at 239⅞. He received two 8 % dividends, and sold Dec. 13, 1911, at 158⅛. What was the total loss, counting money worth 6 % interest?

13. On May 5, 1905, I bought 50 shares of N.Y. Central stock at 143, received an 8 % dividend, and sold Jan. 5, 1906, for 156¼. What was my net gain, money being worth 5% ? If I had not sold until Dec. 5, 1907, I should have received another dividend of 6 % and sold for 92⅞. What would have been my net loss?

14. A man bought 40 shares of stock in 1904 at 162. If he has received a yearly dividend of 12 % for 6 years, and is compelled to sell in 1910 at 103½, how much does he lose? (Consider that the investment has run 6 years and that money is worth 5 % simple interest.)

Bonds — Oral and Written Problems

1. What is a bond? In what respect is it like a promissory note? In what respect does it differ?

2. If a $ 2000 bond was bought when quoted at 103⅞, brokerage ⅛, what did it cost? What is it worth at maturity? How much less than it cost is this?

3. When bonds are quoted at 97⅜, what will a $1000 bond cost, if bought through a broker? What is it worth when due?

4. A corporation is bonded for $200,000. The bonds bear 4½ % interest. What yearly interest does the corporation pay?

5. What income will one receive yearly from six $ 500 5 % bonds?

6. A $30 coupon was detached from a 6 % bond, being the interest for one year. What was the face of the bond?

7. How many $1000 4 % bonds are necessary to yield an annual income of $1200?

8. When one buys a $1000 5 % bond, due in 3 years, at 96⅞, brokerage ⅛ %, what does he make besides the interest if he holds it until maturity?

9. If one buys a 4 % $500 bond due in 10 years at $79\frac{7}{8}$, brokerage $\frac{1}{8}$, what does it cost him? What is it worth at maturity? What is the yearly income from interest? What is the average yearly income, including the gain at maturity? To what rate of interest is this equivalent?

10. Which would you prefer to buy, 5 % bonds at 90 due in 5 years, or at 80 due in 20 years?

11. Give the cost of a $1000 bond in each of the following corporations, allowing $\frac{1}{8}$ for brokerage: —

Argentine	5s	$95\frac{7}{8}$	C. B. & Q.	4s	$96\frac{1}{2}$
Rep. of Cuba	5s	$103\frac{1}{8}$	C. M. & St. P.	4s	$100\frac{1}{8}$
U.S. of Mexico	4s	$94\frac{1}{4}$	Iowa Cent.	5s	$106\frac{7}{8}$
Am. Tobacco	6s	$106\frac{7}{8}$	P. & M.	4s	$78\frac{3}{4}$
Armour & Co.	$4\frac{1}{2}$s	$94\frac{3}{8}$	St. P. & M. M.	$4\frac{1}{2}$s	$89\frac{1}{4}$
Balt. & Oh.	4s	$92\frac{1}{2}$	St. L. & S. W.	4s	$93\frac{1}{8}$
Cent. of N. J.	5s	$124\frac{1}{2}$	Va. & S. W.	5s	·98

12. Give the year's income from a $1000 bond in each of the corporations listed in Ex. 11.

13. I receive an income of $200 from 4 % bonds. What is their face value? Their market value at 108?

14. I receive $30 each year as interest on a 6 % bond. What is its face value? Its market value at 98?

15. I wish to secure an income of $1200. How much shall I spend for 4 % bonds bought at par to do this? How much at 102?

16. The semiannual coupon of a government 2 % bond is worth $50. What is the value of the bond at 104?

17. A father gives his son sufficient 5 % bonds to pay his college expenses with their income. His expenses amount to $800 a year. What is the face value of the bonds? What did they cost through a broker at 110?

18. I receive $25 a year as interest on a bond whose face value is $500. What is the rate of interest?

19. If a five-thousand-dollar bond yields $250 annually, what must the rate of interest be?

20. $45 is the interest on a thousand-dollar city bond. What per cent does the investment pay if bought at par?

21. A coupon evidently cut from a 5 % bond called for the payment of $40 interest. If the interest was payable semi-annually, what is the face of the bond?

22. A bankrupt corporation pays 70 % of the face value of its bonds. I hold 3500 dollars' worth; what shall I lose?

23. The trustees of a library purchase 4 % bonds at 112½ to the amount of $22,500, and devote the annual income to the payment of the librarian; what salary does she receive?

Taxes — Written Problems

1. 1. What are taxes? 2. What is a poll tax? 3. A property tax? 4. What is the difference between personal property and real estate? 5. What are assessors? 6. What is an inventory?

2. If the tax is $16 on every thousand dollars of the valuation of my property, how large will my tax be if I am assessed for $5000?

Find the tax to be raised on the property under the following conditions: —

	Total Tax	No. of Polls	Single Poll Tax		Total Tax	No. of Polls	Single Poll Tax
3.	$28,000	218	$1.50	**6.**	$740,000	9,287	$2.00
4.	$27,500	960	$1.75	**7.**	$752,000	10,426	$2.50
5.	$76,400	2580	$2.00	**8.**	$427,000	7,315	$2.15

Find the rate of taxation on a thousand dollars under the following conditions: —

	Assessed Valuation	Tax to be raised on Property		Assessed Valuation	Tax to be raised on Property
9.	$48,000	$1,200	13.	$51,000,000	$750,000
10.	$650,000	$1,300	14.	$49,000,000	$630,000
11.	$1,650,000	$110,000	15.	$135,000,000	$900,000
12.	$2,470,000	$190,000	16.	$215,000	$2,700

17. The valuation of property in a certain town is $2,306,000. The tax to be raised on the property is $39,202. What must the rate be?

Property Insurance — Oral Problems

1. 1. Why do people insure their houses, furniture, ships, etc.? 2. What are underwriters or insurance companies? 3. What do we call the sum paid in cases of loss by fire or shipwreck? 4. What do you understand by the expression "2% premium"? 5. What name is given to the contract between the insured and the insurer? 6. Is property generally insured for its full value? Give your reason.

2. I value my house at $6000. It is insured for five years at 1½%. What premium did I pay, if the insurance is half the value? What is the face of the policy?

3. In case my house burns within the five years, what shall I receive from the insurance company?

4. I have an insurance of $3000 on my yacht. This is ¾ of its value. What is my loss in case of its being totally wrecked?

5. The premium is $28, or 2% of the insurance. What is the face of the policy?

6. I paid $36 insurance on ⅔ the value of my store. The rate of premium was 1%. What was the value of my store?

7. Insured a stock of goods worth $40,000 at ¾ their value at a premium of ½%. What was the cost of the insurance?

8. A hotel costing $50,000 is insured for 3 years on half its value at 1% a year. What is the premium?

9. A cargo is insured for ⅜%. If the premium is $120, what is the face of the policy?

10. A church is insured for $5000 in each of five different companies The premium is $500. What is the rate of insurance?

11. An insurance company with a capital of $150,000, after paying all losses and expenses, finds the net profits to be $7500. What rate of dividend do the stockholders receive?

12. What is the premium on a $12,000 policy at 1¾%?

13. Goods worth $9000 are insured for ⅔ their value. What is the rate if the premium is $75?

14. My 2% premium upon goods insured for ¾ their value is $96. What is the value of my goods?

Insurance — Written Problems

1. A factory worth $60,000 is insured for ¾ its value at 1⅞%. The possible loss to the owner, including the premium, is how much?

2. $175 was the premium on ¾ the value of a collection of paintings at 1% a year. What was the value of the paintings?

3. A house was insured for ¾ its value at 1½ % premium. The premium was $27. Find the value of the house.

4. A cargo was insured for ⅔ of its value at ⅜%. The premium paid was $3750. What is the value of the cargo?

5. A manufacturer pays $800 premium at ⅖%. The property is partly destroyed by fire, and the adjuster settles with him for 52% of the insurance. What does he receive?

CANCELLING INDEBTEDNESS

Camden, N.J., June 4, 1910. *No. 1243.*

The First National Bank of Camden

Pay to ...Simmons & Newton...or order........$98.20......

Ninety-eight and $\frac{20}{100}$ Dollars.

........E. A. Bacon........

---

1. In the above check who receives the $98.20?

2. Who pays it to them? Whose money is the bank paying out?

3. What indorsement will be necessary before the bank pays the check?

4. Do banks usually charge a fee (exchange) for collecting a personal check upon a bank in some other city?

5. When are checks generally used in cancelling indebtedness?

$234. *Albany, N.Y., July 8, 1910.*

TENTH NATIONAL BANK

Pay to the order of Howe & Co.

Two hundred thirty-four and $\frac{no}{100}$ Dollars.

To the Farmers' National Bank,
Syracuse, N.Y.

....Patrick Matthews....
Cashier.

6. Compare the preceding draft with the check. That is, in what respect are they alike? How are they different?

7. Of what bank is Matthews cashier?

8. Where is the draft payable? To whom?

9. In what way may Howe & Co. make it payable to another party?

10. When are drafts used in preference to checks in cancelling indebtedness?

11. If Howe & Co. are going to mail this draft to E. L. Harris & Co., how should it be indorsed? Why is it better for Howe & Co. to "indorse in full," than merely to sign their name across the back?

12. If Howe & Co. prefer, they may have the draft made payable directly to E. L. Harris & Co. Which do you think would be the better plan?

No. 3465. *Boston, Mass., May 6, 1910.*

At sight pay to the order of

The Shawmut National Bank *$580*

Five Hundred eighty and $\frac{\text{no}}{100}$ *Dollars.*

To J. R. Smith & Co.,

Peoria, Ill. *C. H. Anderson & Co.*

13. When is a *sight draft* like the form shown above used in collecting money?

14. Who is "being drawn upon"? Who receives the money?

15. Suppose this to have been a 60-day time draft and to have been accepted May 10. What is the day of maturity and how long has the draft to run before due?

16. If sold on the day of acceptance at 6% discount, what are the proceeds? (Remember that when accepted it is practically a promissory note.)

17. The bank at Peoria will likely charge a small fee for collecting the draft. If they charge ¼% (of the face of the draft) for collecting (exchange) and discount it on the day it is bought, what shall they remit the Shawmut National Bank in Boston?

18. F. Alton of New Orleans draws at sight on F. Fay of Waco, Tex., Aug. 3, 1910, for $500. Make the draft.

19. Suppose the debt not due till Nov. 1. Make a proper time draft dated Aug. 3.

20. If discounted Aug. 18, the proceeds would be what?

21. If discounted Aug. 3, less an additional ½% for exchange, the proceeds would be what?

22. A Charleston bank buys a draft on Richmond for $2100, charging ½% for exchange. If it had taken the draft for collection only, the charge would have been 25 ct. To the maker what is the difference in money? In which case is payment made more quickly?

23. Write a draft of which you are the maker, your teacher the payee, and a neighboring bank the drawee.

24. Suppose that you bought of E. L. Holman & Co. a bill of hardware as follows: —

26 doz. axes at $4.80; 32 doz. files at $1.20; 36 doz. saws at $3.40. Discounts 40% and 10%. Terms: 2% discount for cash in 10 days; net 60 days.

Make out a bill for this, showing the net cash price. Send a draft in payment. What is the face of the draft? Where will you get it? To whom will you have it payable? If made payable to yourself, how will you indorse it before sending it?

25. F. R. Smith & Sons bought of J. L. Morris & Co. the following: —

2 safes at $ 12.50; 3 armchairs at $ 9; 2 rockers, leather, at $ 25; 1 couch at $ 8; 3 couches at $ 6.50; 2 rockers at $ 9. Terms: net 60 days.

Make out the proper bill, finding the price in 60 days. Pay with a 60-day note without interest. Suppose that Morris & Co. receive the note and discount it 5 days after date at 6 %. What are the proceeds? Who gets them? Who gets the discount? What indorsement is necessary before selling the note? What obligation is assumed when one indorses a note?

26. Suppose you bought of M. E. Dawson & Co. the following: —

4 kitchen cabinets at $ 13.25; 3 kitchen cabinets at $ 15.25; and 1 kitchen cabinet at $ 17.75. Terms: 2 % off for cash in 10 days; net 30 days.

Make out the proper bill. Find the net cash price. Send them your check for the payment. What will Dawson & Co. do with this check when they receive it? What will a postal money order to settle the bill cost?

27. A. L. Morgan of Salem, Ill., bought of Reed, Murdock & Co., Chicago, the following: —

86 lb. tea at 43 ct.; 280 lb. coffee at 28 ct.; 250 lb. prunes at $11\frac{1}{2}$ ct.; 116 lb. raisins at 14 ct.; 144 cans salmon at 15 ct.; 86 lb. apricots at 18 ct. Terms: 60 days net; 2 % off for cash in 10 days.

Make out the proper bill if not paid for 60 days. At the end of 60 days the firm draws a sight draft on Morgan. Make out the proper form. What would Reed, Murdock & Co. do with this draft? What then becomes of it?

28. I. C. Carpenter bought of The Van Cleve Glass Co. the following: —

3 boxes 7 × 9, single, at $26.75; 5 boxes 10 × 14, single, at $28.25; 2 boxes 16 × 20, single, at $30; 5 boxes 12 × 20 single, at $28; 6 boxes 18 × 24, single, at $31.75. Discounts 85 % and 10 %. Terms: 60 days net or 2 % off in 10 days.

Write out a check for the cash payment. How much more would the Glass Co. receive by taking a 60-day note without interest and discounting at a bank at 6 % 10 days from the date of the bill?

29. R. L. Stevens & Sons sold to J. H. Boyce the following on 90 days' time, drawing a 90-day draft on Boyce when the goods are billed: —

2 rockers at $13.50; 1 rocker at $8.25; 2 Morris chairs at $15; 3 chairs at $3.75; 1 hall tree at $11.50; 1 hall tree at $13.75. Terms: net 90 days.

Make out the proper bill; the proper draft. The draft is "accepted" and discounted at 6 % in 5 days from date. How much do Stevens & Sons really get in cash for the goods?

Miscellaneous Problems — Written

1. A man owing $85,000 failed, and paid but 52 cents on the dollar. What per cent did he pay? How much did he pay? What was my loss if he owed me $4500?

2. My household expenses this month were $108.35. This was 10 % more than the average monthly expenses for the year. Find my yearly household expenses.

3. Find the bank discount of a note for $385 (without interest) dated Aug. 15, 1910, to run 60 days, discounted Aug. 25 at 6 %.

4. Find the bank discount of the above note if it is bearing 5 % interest.

5. A merchant insured his goods at $\frac{4}{5}$ their inventory value at $1\frac{1}{2}$ %. What was their value if the premium was $75?

6. A man discounted his 60-day note at 6 % and received $495 for it. Find the face of the note.

7. Find the proceeds of an $800, 5 % note to run 4 months if discounted at 6 % 20 days before it is due.

8. I bought a piano listed at $650, but received a discount of 30 % and 10 %. How much did it cost me?

9. A man bought 50 shares of mining stock at 87½, received an 8 % dividend, and sold it at 92⅞. How much did he make, considering brokerage ⅛ in each transaction?

10. A father left 66⅔ % of his estate to a son and the remainder, $75,400, to a daughter. What was the value of the estate? How much did the son receive?

11. A merchant failing in business finds his resources to be but $40,950, while his liabilities are $65,000. What per cent of his indebtedness can he pay? What will a man lose to whom he owes $4200?

12. One year a man had a wheat crop that averaged 28.4 bushels per acre, for which he got 98 cents a bushel. The next year when he received $1.15 per bushel, his income per acre was decreased 2 %. Find the average yield the second year.

13. In New York City 614,474 houses are rented and 83,792 owned. In Philadelphia 196,289 are rented and 55,363 owned. In Chicago 258,582 are rented and 86,435 owned. Compare the per cent of people who own their houses in these three cities.

14. A man paid $14,300 for two houses. If he paid 20 % more for one than the other, how much did each cost?

15. A merchant's sales decreased 16⅔ % this year from last year's sales. This was $96,720. Find the amount of his sales for the two years.

16. What is the interest of $450 at 4 % for 2 yr., 9 mo., 27 da.?

17. What principal will gain $19.50 in 1 yr., 6 mo. at 4 %?

18. How long must $475 be on interest at 6 % to gain $95?

19. At what rate will $500 gain $50 in 2 yr., 6 mo.?

20. What will $1250 amount to in 8 yr., 6 mo., 15 da., at 4 %, simple interest?

21. My agent collects $550 for me at 5 % commission. How much do I get?

22. I forwarded to my agent enough money to make an investment for me and to pay his commission of 3 %. If his commission was $72, what was my investment?

23. A house worth $6300 was insured for $\frac{2}{3}$ its value at $1\frac{3}{4}$ %. Find the premium.

24. $28 = premium; $\frac{1}{4}$ % = rate of insurance; for how much was the property insured?

25. A man buys 200 stoves at $27.50. The trade discount is 20 %, with 10 % off for cash. For how much cash could he pay for his stoves?

26. $448,000 = town valuation of property. $2688 = taxes assessed. ? = tax on $1.

27. If 95 % of a ship is valued at $49,970, what is $67\frac{1}{2}$ % of it worth?

28. (*a*) In what time will $400 gain $70 at 5 %? (*b*) At what rate will $160 gain $14 in 1 yr., 9 mo.?

29. A commission merchant sold 1560 lb. of butter at 25¢ a pound. What was his commission at 10 %?

30. For selling 600 yd. of carpet at $1.20 a yard an agent receives $36. What rate per cent was his commission?

31. I buy goods at discounts of 20 %, 25 %, and 10 % from the list price. For what per cent of the list price do I buy?

32. A bill of books amounting to $250 is reduced to what net amount by discounts of 20 % and 10 %?

33. A house valued at $4800 is insured for ¾ its value at 1½%. What was the amount of the premium?

34. At 30¢ a dozen and 30% *ad valorem*, find the duty on 500 doz. linen collars valued at $1.20 a dozen.

35. A man sold a house at 20% profit, and with the proceeds he bought another which he sold at 30% profit; the sum of his profits on both sales was $3145. What did he pay for each house?

36. A dealer bought 380 long tons of coal at $4.20 per long ton and sold it at $5.75 per short ton. What was his gain if 1% is allowed for waste in weight, 7¢ a 100 lb. for freight, and $114 for hauling, etc.?

37. A man received $1560 as the annual 12% dividend on stock that he owned. He afterward sold 35 shares at 142¼ per share and the remainder at 143 per share, brokerage ⅛% on each sale. What were the net proceeds of each sale?

38. A man pays $14.40 for a grate; the retailer sold it to him at 25% gain, the wholesaler to the retailer at 10% gain, and the manufacturer to the wholesaler at 15% gain. How much more than the actual cost to the manufacturer does the consumer pay?

39. A man sold a house at 20% profit, and with the proceeds bought another which he sold at 30% profit, realizing a total gain of $6373 on both. Find the cost of each.

40. A New York importer bought 1800 yd. Brussels carpet, ¾ of a yard wide, invoiced at £300 ($1459.95 United States money). The specific duty is 28¢ per square yard, *ad valorem* duty 40%. What is the total duty? Ocean freight and charges on this side amount to $278.25. At what price per yard must he sell the carpet to gain 20%?

41. Coffee costing 19½¢ per pound lost 10% in roasting. For how much must it sell in order to gain 16⅔%?

42. A farm was bought for $11,360; fencing cost $675, breaking $745, a house $2590, and barns $1310. The farm was sold at a profit of 20% on the investment; 65% was paid in cash and the balance by a note. What was the amount of the note?

43. A commission merchant sold for a consignor 650 lb. of butter at 30¢ a pound. His charges were freight $4.43 and commission $2\frac{1}{4}$%. He invested the proceeds in coffee @ 28¢ a pound. How many pounds did he buy if he charged $1\frac{1}{2}$% for buying?

44. A note for $1080, dated Jan. 10, 1910, payable in 90 days, with interest at 6%, is discounted Feb. 27 at 6%. Find the bank discount and the proceeds at 360 days to the year.

45. A. Morton bought of Grant Bros. Feb. 18, 1910, terms 2% off if paid in 10 days, net 30 days, 900 ft. iron pipe at 32¢ less 25% and 10%; 65 elbows at 20¢ less 20% and 10%; 145 yd. asbestos at 54¢. Make out the bill of Grant Bros. payable Feb. 28, 1910.

CHAPTER VII

SQUARE ROOT — MENSURATION

Oral Problems

1. What is the square root of 81? Of 256? Of $2\frac{1}{4}$? Of $30\frac{1}{4}$? Of 625? Of 10,000?

2. Which of these numbers are perfect squares: 0.09, 0.90, 0.009, 0.0009?

3. What does the side of a square measure when the area is 121 square inches?

4. A rectangle is 10 inches wide and 30 inches long. How many 10-inch squares will it make?

5. The area of a rectangle is 48 square inches. Its length is 3 times its width. What are its dimensions?

6. What is the distance around a square ten-acre field?

7. Find the square root of the following numbers. If the number is an imperfect power, find the approximate root: 576, $1\frac{11}{25}$, 0.0625, $1\frac{15}{49}$, $\frac{16}{121}$, 102.01, 6.25, 1.21, 1.44, $2\frac{7}{81}$, 230, 225, 69, $1\frac{9}{16}$, $2\frac{1}{4}$, $1\frac{7}{9}$, $5\frac{4}{9}$, 104.04, 4.41, 30.25, $9\frac{3}{4}$.

Written Problems

Find the root of these powers: —

1. $\sqrt{78400}$
2. $\sqrt{3025}$
3. $\sqrt{21609}$
4. $\sqrt{47961}$
5. $\sqrt{27890}$
6. $\sqrt{77841}$
7. $\sqrt{112225}$
8. $\sqrt{199809}$
9. $\sqrt{152881}$
10. $\sqrt{2117025}$
11. $\sqrt{30.25}$
12. $\sqrt{0.001089}$
13. $\sqrt{0.00008836}$
14. $\sqrt{0.012321}$
15. $\sqrt{2.8224}$
16. $\sqrt{590.49}$
17. $\sqrt{670.8100}$
18. $\sqrt{15.3664}$
19. $\sqrt{0.0312481}$
20. $\sqrt{19.9809}$
21. $\sqrt{\frac{576}{625}}$
22. $\sqrt{\frac{441}{929}}$
23. $\sqrt{\frac{961}{1024}}$
24. $\sqrt{\frac{16}{3025}}$
25. $\sqrt{\frac{9}{1849}}$
26. $\sqrt{\frac{289}{5625}}$
27. $\sqrt{\frac{3136}{3969}}$
28. $\sqrt{\frac{121}{11881}}$
29. $\sqrt{\frac{324}{9801}}$
30. $\sqrt{\frac{1521}{4761}}$
31. $\sqrt{182\frac{1}{4}}$
32. $\sqrt{18\frac{28}{36}}$
33. $\sqrt{7\frac{673}{729}}$
34. $\sqrt{6\frac{688}{1296}}$
35. $\sqrt{6\frac{43}{81}}$
36. $\sqrt{4\frac{177}{961}}$
37. $\sqrt{12\frac{1}{4}}$
38. $\sqrt{3\frac{613}{841}}$
39. $\sqrt{6\frac{394}{1225}}$
40. $\sqrt{6\frac{75}{529}}$

41. The area of a square field is $5\frac{3}{8}$ acres. How long will it take a man to walk around it, at the rate of a mile in $10\frac{2}{3}$ minutes?

42. $\sqrt{(134^2+17^2-2\times 134\times 17)}$. **43.** $\sqrt{4\frac{5}{7}\times\frac{6}{11}\times 3\frac{3}{5}\times 11\frac{2}{3}}$.

44. Find the length of a square field containing 1000 acres.

45. If it cost $312 to inclose a field 216 rods long and 24 rods wide, what will it cost to inclose a square field of equal area with the same kind of fence?

46. In the center of a square garden there is a pond, covering an area of 810 square feet, which is $\frac{1}{10}$ of the whole garden. How many rods of fence will inclose the whole garden?

The Rectangle — Written Problems

1. Describe a rectangle. How is the area found?

2. How many square feet in the walls and ceiling of a room 24 ft. long, 16 ft. wide, and 9½ ft. high?

3. How many square yards in a garden 72 ft. wide and 150 ft. long?

4. How many yards of 27-in. carpet are required for a room 15 ft. wide and 24 ft. long, not allowing for waste in matching?

5. If shingles 4 in. wide are laid 4 in. to the weather, how many are required for a roof 20 ft. by 30 ft., making no allowance for waste or a double row at the bottom?

6. A farmer paved the bottom of his cellar, which is 36 ft. by 42 ft., with stone flagging at 25 cents a square yard. What was the cost?

7. How many bricks 8 in. long and 4 in. wide are required to lay a walk 80 ft. long and 4 ft. wide?

8. A rectangular piece of land 40 rd. wide and 70 rd. long contains how many acres?

9. At 33⅓ cents a square yard, how much will it cost?

10. A square field contains 10 A. How many rods of fence will be required to inclose it?

11. How many yards of 36-in. carpet are required to cover a floor 12 ft. wide and 14 ft. long, no allowance being made for matching?

12. How many strips, running lengthwise, of Brussels carpet (27 in. wide) are required for a room 15 ft. by 20 ft.? How many running yards in each strip? How many running yards in all, if there is no waste in matching? What is the cost at $1.25 per yard?

13. A rectangular piece of land is 40 rods wide and 55 rods long. Find the area in square rods; in acres.

14. How many acres in a city block 400 ft. by 600 ft.?

15. How much does it cost to construct a concrete sidewalk 5 ft. wide and 164 ft. long at $1.25 per square yard?

16. What does it cost to pave a street 42 ft. wide and 400 ft. long at $1.62 per square yard?

17. How many bricks 8 in. long and 4 in. wide are required to lay a sidewalk 6 ft., 8 in. wide and 64 ft. long?

18. What does it cost to lath and plaster a room 14 ft. by 16 ft. and 10 ft. high, at 33 cents per square yard, no allowance being made for openings?

19. How many tiles 8 in. square will it take to cover a court 33 ft., 4 in. long and 16 ft., 8 in. wide?

20. A square park contains 1000 A. How many yards of iron fence does it take to inclose it?

21. A rectangular tank 8 ft. long, 3 ft. wide, and 1 ft., 6 in. deep will require how many square feet of sheet copper, allowing 10% extra for waste, laps, etc.? If the tank is made from sheet copper weighing 12 lb. per square foot, what will the material cost at 25 cents a pound?

22. A gallon of paint costing $1.50 covers 300 sq. ft. with one coat. Find the cost of painting a tight board fence with one coat on each side if the fence is 4 ft., 6 in. high, and incloses a lot 21 rd. long and 9 rd. wide.

23. How many square feet of boarding will be required to make 1000 packing cases, each 27 in. long, 18 in. wide, 12 in. deep, adding 10% extra for the waste on each box?

24. How many square feet of sheathing are necessary for the outside, including top, of a freight car 34 ft. long, 8 ft. wide, and 7½ ft. high, adding 10% extra for waste?

THE THEOREM OF PYTHAGORAS

Written Problems

1. Show that,

The square upon the hypotenuse of a right-angled triangle equals the sum of the squares upon the other two sides.

2. The base of a right triangle is 48 feet, and the perpendicular is 36 feet. What is the hypotenuse?

3. The hypotenuse is 85 feet and the perpendicular is 51 feet. What is the base?

4. The base is 76 feet and the hypotenuse is 95 feet. What is the perpendicular?

5. What is the diagonal of a rectangle 92 feet long and 69 feet wide?

6. What is the diagonal of a 30-foot square? What is the longest line that can be drawn on a sheet of paper 16 inches wide and 20 inches long?

7. What is the diameter of the largest wheel that can be got through a doorway measuring 7 feet by 5?

8. A square field contains 10 acres. What is its diagonal?

9. What is the distance between the opposite corners of a field 200 rods long and half as wide?

10. How many rods do I save by taking the diagonal of a field 75 rods wide and 200 rods long, instead of going around the corner?

11. What is the altitude of an equilateral triangle whose base is 24 feet?

12. From the corner of a 12-inch square I cut an isosceles triangle one of whose equal sides is 5 inches. What is the area of that part of the large square which remains?

13. The base of an isosceles triangle is 84 feet, and one of the other sides is 50 feet. What is the altitude?

14. My son's kite is 1500 feet directly above the spot on which I am standing, and my son holds the string 1800 feet away. How much string has he let out? Allow 25 feet for sagging.

15. A flagpole is 125 feet high. Another pole on the opposite side of the street, 60 feet wide, is 75 feet high. What is the distance between the tops of the two poles?

16. What must be the length of a guy rope if one end of the rope is attached to the derrick 50 feet from the ground and the other is attached to the ground 30 feet from the foot of the derrick?

17. What must be the length of a ladder to reach to a window 30 feet from the ground if it rests on the ground 8 feet from the wall of the building?

THE CIRCLE

Written Problems

1. What is the relation of the circumference of a circle to its diameter?

2. How is the area of a circle found? Explain how the rule is obtained.

3. Find the diameter of a wheel that makes 660 revolutions in going a mile.

4. How many revolutions per mile will a 28-inch bicycle wheel make?

5. What is the area of a circular ring that is 3 inches in inside diameter and 4 inches in outside diameter?

6. The circular basin of a fountain is 20 feet in diameter. What will it cost to cement the floor of it at $1.75 per square yard?

7. If tool steel can stand a cutting speed of 30 feet per minute, how many revolutions per minute may the lathe be run when turning down a shafting 15 inches in diameter?

8. When three fly-wheels whose diameters are 10 feet, 12 feet, and 15 feet, respectively, each have the same circumferential speed of 3600 feet per minute, how many revolutions per minute is each making?

9. The earth is nearly 8000 miles in diameter. What is the approximate length of the equator? At what velocity does a person who is at the equator revolve through space?

10. A cylindrical tin can is to be made 4 inches in diameter and 4½ inches high. Find the dimensions of the piece of tin that is to form the cylindrical surface, ¼ inch being allowed for a seam.

SOLIDS: PRISMS AND CYLINDERS

Oral Problems

1. How is the volume of a rectangular prism found? Of any prism?

2. How many cubic feet in a box 4 ft. long, 3 ft. wide, and 1½ ft. deep?

3. A cellar is 40 ft. long, 30 ft. wide, and 7½ ft. deep. How many cubic feet of earth were removed in its construction?

4. The wagon box most generally used in hauling earth is 9 ft. by 3 ft. by 16 in. How much dirt will a load contain?

5. Compare the rule for finding the volume of a cylinder with that for finding the volume of a prism. Show how to obtain the rule.

6. Explain the meaning of the following formulæ used in finding volume: —

(a) $V = s^3$; (b) $V = abc$; (c) $V = Ah$; (d) $V = h\pi r^2$.

Written Problems

1. A square bin 3 ft. deep contains 75 cu. ft. Find its length and width.

2. The altitude of a cylinder is 6 in. and the radius of its base 2 in. Find its lateral area; its total area; its volume.

3. The volume of a cylinder is 2772 cu. cm. and its altitude 12 cm. Find its lateral area to one decimal place.

4. A freight car is 36 ft. long and 8 ft., 6 in. wide inside measure. How many bushels of wheat will it contain if loaded to a depth of 5 ft.? What is the weight of a car of wheat? (A cubic foot is approximately .8 bu. 1 bu. of wheat weighs 60 lb.)

5. The excavation for a house is to be 40 ft. long, 28 ft. wide, and 6 ft. deep. How many cubic yards (loads) of earth must be removed? What is the cost at 35 cents per cubic yard?

6. A stone mason furnishes the material and lays a front wall 42 ft. long, 8 ft. high, and 16 in. thick at $5.75 per cubic yard. Find the cost.

7. A stonemason builds 4 pillars, each 3 ft. by 3 ft. by $7\frac{1}{2}$ ft. high, and a front wall 36 ft. long, 3 ft. high, and 18 in. thick, charging $25 per cord (128 cu. ft.) for the work and material. Find the total cost.

8. How many cords of wood in a rick 4 ft. wide, 16 ft. long, and 6 ft. high?

9. What must be the height of a tomato can to hold a quart (57.75 cu. in.) if its diameter is 4 in.?

10. The volume of an irregularly shaped object may be found by submerging it in a cylindrical vessel of water. When a stone is submerged in a cylindrical vessel 8 in. in diameter, the level of the water rises 4 in. Find the volume of the stone.

11. How many cubic yards of earth must be removed to dig a cistern 9 ft. in diameter and 10 ft. deep?

12. The cross section of a tunnel is in the form of a square with a side 16 ft., surmounted by a semicircle. The tunnel is 132 yd. long. How many cubic yards of earth are removed in its construction?

13. An oil tank is 6 ft. in diameter and 15 ft., 3 in. long. How many gallons does it hold? (1 cu. ft. = 7.84 gal.)

14. What is the cost of cementing the side and bottom of a well 4 ft., 8 in. in diameter, and 30 ft. deep, at 45 cents per square foot?

15. A boiler has 200 tubes 10 ft. long and 3 in. inside diameter, conveying the heat through the water. What is the area of the inside tube-heating surface?

16. What will a 2-inch (diameter) iron bar 10 ft. long weigh if iron weighs 480 lb. per cubic foot?

17. What is the weight of an 18-foot. steel bar whose average cross-section area is 8¼ sq. in.? (1 cu. ft. = 490 lb.)

18. A tank 4 ft., 2 in. long, 3 ft. wide, and 5 ft., 6 in. high holds how many gallons? (A gallon = 231 cu. in.)

19. How many tons of ice can be packed in an ice house 40 ft. by 24 ft., and 16 ft. high, allowing 2 ft. on each side and above and below for sawdust? (1 cu. ft. weighs 56.25 lb.)

20. How many square feet of ice must be cut to fill a car 34 ft. long, 8½ ft. wide, 5 layers deep? What will the car of ice weigh if it is 14 in. thick?

21. An ice box will hold a piece of ice 32 in. long, 24 in. wide, and 14 in. thick. What will such a piece weigh?

22. A cylindrical tank for supplying water to a locomotive is 24 ft. in diameter and 16 ft. high. Finds its capacity in gallons. (7½ gal. = 1 cu. ft.)

23. Three oil cans are of the same height. Two of them are each 10 in. in diameter and the other 15 in. Compare the capacity of the large one with that of the other two.

24. A drumhead 21 in. in diameter is cut from a sheet of $\frac{3}{8}$-in. steel plate 22 in. square. What is the weight of the steel cut off? ($\frac{3}{8}$-in. steel plate weighs 15.3 lb. per square foot.)

25. A 38-ft. tank car has a tank 93 in. inside diameter and 34 ft. long. How many gallons will it contain? (231 cu. in. = 1 gal.)

26. Find the weight of a block of steel 4 in. by 8 in. by 14 in., containing 4 circular $1\frac{1}{2}$-inch holes 4 inches deep, and a half-round 3-inch groove 14 in. long. (1 cu. in. of steel = 0.238 lb.)

27. What is the edge of a cube whose volume equals that of the block in Problem 26?

SOLIDS: PYRAMIDS, CONES, SPHERES

Oral Problems

1. The volume of a pyramid is what part of the volume of a prism having the same dimensions? What is the volume of a pyramid 10 ft. high, the area of whose base is 56 sq. ft.?

2. Compare the rule for finding the volume of a cone with that of a pyramid.

3. Compare the surface of a sphere with that of one of its great circles.

4. How is the volume of a sphere shown?

5. Explain the meaning of the following formulæ: —
(a) $V = \frac{1}{3} Ah$; (b) $V = \frac{1}{3} h\pi r^2$; (c) $S = 4\pi r^2$; (d) $V = \frac{4}{3}\pi r^3$.

6. What part of a square prism is whittled away by a boy who is making the largest possible pyramid out of it?

7. The contents of a square prism are 36 cu. in. How many cubic inches in a square pyramid of the same dimensions?

8. A bar of iron 12 in. by 2 in. by 3 in. will make how many pyramids of the same dimensions?

9. The largest possible cone is turned in a lathe out of a cylinder. What part goes to shavings?

Written Problems

1. If a sphere 3 inches in diameter is carefully turned out of a 3-inch cube, what part of the cube will go into shavings, and what part will remain in the sphere?

2. If a sphere is 0.5236 of a cube of the same diameter, what will be the contents of the sphere 4 inches in diameter?

3. If a cubic foot of iron weighs 450 pounds, what is the weight of an iron sphere 12 inches in diameter?

4. A cubic foot of ivory weighs 114 pounds. What is the weight of a set of 4 billiard balls 2 inches in diameter?

5. How many cubic miles in the moon, if we call its diameter 2000 miles?

6. If we call the diameter of the earth exactly 8000 miles, how many moons will be equal in volume to the earth? Shorten your work by cancellation.

7. Two 4-inch spheres are dropped into a pail even full of water and holding 864 cubic inches. How many cubic inches of water are displaced?

8. How does the curved surface of a hemisphere compare with its flat surface?

9. What is the surface of 4 great circles of a 5-inch sphere? What is the circumference of this sphere?

10. Find the square inches in the surface of a 6-inch sphere.

11. A cubic foot of water weighs 1000 ounces, and gold is about 19 times as heavy. What would a sphere of gold 3 inches in diameter weigh?

12. How many square miles in the surface of the moon? Call its diameter 2000.

13. A hollow spherical steel shell is 1 inch thick, and its outside diameter 10 inches. Steel weighs 7.8 times as much as water, and a cubic foot of water weighs about 1000 ounces. Find the weight of the shell in pounds.

14. Two spheres of lead, of radii 2 inches and 4 inches, respectively, are melted and recast into a solid cylinder of height 6 inches. Show that the surface exposed is unchanged in amount.

15. A hollow sphere of brass is found to weigh 50 pounds. Its external diameter is 10 inches. What is its inside diameter? Its thickness? (1 cu. in. of brass weighs 0.303 lb.)

SPECIFIC GRAVITY

Written Problems

SPECIFIC GRAVITIES, REFERRED TO WATER

Platinum	22.	Brass	8.4.	Sulphuric acid	1.84.
Gold	19.3.	Steel	7.8.	Sea water	1.025.
Mercury	13.6.	Tin	7.3.	Linseed oil	0.94.
Lead	11.3.	Zinc	7.2.	Ice	0.92.
Silver	10.5.	Cast-iron	7.	Alcohol	0.79.
Bronze	8.9.	Granite	2.7.	Petroleum	0.7.
Nickel	8.9.	Glass	2.5.	Oak	0.6.
Copper	8.9.	Sulphur	2.	Cork	0.24.

NOTE. The *specific gravity* of a substance is the ratio of the weight of that substance to the weight of an equal volume of some substance taken as a standard. For the specific gravity of solids and liquids, distilled water is usually taken as the standard substance. For gases, either air or hydrogen is taken as the standard.

1 *cu. ft. of water weighs* 1000 *oz. or* 62.5 *lb.*

1 *cu. cm. of water weighs* 1 *g. or* 0.035 *oz.*

1. Find the weight of a cubic foot of each of the following: cast iron; granite; glass; gold; silver.

2. A piece of zinc weighs 1125 lb. How many cubic feet are there?

3. How many cubic feet of glass weigh 1572.5 lb.?

4. Find the weight of 1 cu. yd. of cork; of sulphur.

5. Find the weight of 10 gal. of sea water.

6. Find the weight of 1 gal. of alcohol; of 1 gal. of petroleum.

7. What is the weight of a block of ice 12 in. thick, 18 in. wide, and 36 in. long?

8. How many tons of ice will an ice house hold that is 24′ by 30′ by 20′, allowing 2½ ft. on all sides and above and below for sawdust?

9. The specific gravity of good milk is 1.032. If 520 cu. cm. of the milk taken from a can in a certain dairy wagon are found by the inspector to weigh 532 g., is the milk good?

10. One cubic foot of a certain kind of limestone is found to weigh 187.5 lb. What is the specific gravity?

11. How many ounces of alcohol will a "two-ounce" bottle hold?

12. How many grams of mercury in a glass tube whose cross-sectional area is 1 sq. cm. and length 20 cm.?

13. A steel beam 16 ft. long, 2¼ in. wide, and 8 in. thick weighs how much?

14. An iceman delivered a block of ice 1 ft. long, ⅝ of a foot wide, and ¾ of a foot thick, and charged for 50 lb. What was the shortage in weight?

15. A steel beam is 16 ft. long, 2⅝ in. thick, and 14 in. wide. What is its weight?

16. What is the weight of a block of ice 6½ ft. × 1¼ ft. × 4⅔ ft.?

17. Find the weight of a cast-iron pipe 1.3 ft. long, 10-in. outside diameter, and ⅞ in. thick.

18. What is the weight of a hollow steel pillar 10 ft. long, whose external diameter is 5 in., and internal diameter 4 in.? What is the diameter of a solid pillar of the same weight and length?

19. A hollow sphere of brass is found to weigh 50 lb. Its external diameter is 10 in. What is its internal diameter?

20. A grindstone when new is 6 ft. in diameter and has a 14-in. face. What has it lost in weight when it is worn down 2 in.? (The specific gravity of sandstone is 2.42.)

21. What weight of brass is cut off in turning a cylinder 1 in. in diameter and 1 ft. long from a bar 1¼ in. square and 1 ft. long?

22. A tank car has a tank 7 ft. 9 in. inside diameter and 34 ft. long. What weight of petroleum will it carry?

Mensuration — Miscellaneous Problems

1. What is the area of ½ mi. of street 4 rd. wide?

2. What will the curbing for this street cost at 75¢ a foot?

3. A city lot containing 3725 sq. ft. has a frontage of 50 ft. How deep is it?

4. A swimming tank is 40 ft. long and 18 ft. wide. What will it cost to cement the bottom at $2.25 per square yard?

5. A city block is 600 ft. long and ⅔ as wide. How many acres does it cover?

6. A half a mile of 60-ft. street is paved with granite blocks. How many will be required at the rate of 36 to a square yard?

7. I bought a square lot of land 300 ft. long. I laid out a 40-ft. street through the middle of it in each direction. What was the area of each of the 4 lots that remained?

8. If you cut a 6-in. square out of each corner of a square yard, what part of the latter remains?

9. What will a sheet of zinc 8 ft. long and 32 in. wide cost at $7\frac{1}{2}$¢ a pound, if every square foot weighs 8 oz.?

10. At 75¢ a yard, what will it cost to put a picket fence halfway around a corner lot measuring 72 by 150 ft.?

11. A ball ground measuring 400 ft. by 600 ft. is surrounded by a 12-ft. fence. How many thousand feet of inch boarding were required?

12. Broadway Park measures $\frac{1}{4}$ of a mile by $\frac{3}{8}$ of a mile. What will an 8-ft. granolithic walk around this park cost? Do not leave the corners without a walk. A square yard costs $1.25.

13. How many strips of carpeting running lengthwise will be required in carpeting a room with yard-wide carpeting, if it measures: —

12 ft. by 20 ft.?	13 ft. by 20 ft.?
14 ft. by 20 ft.?	15 ft. by 20 ft.?

14. What will it cost to carpet a hallway 14 ft. long and 11 ft. wide with ingrain carpet at 80¢ a yard, no allowance for matching?

15. A floor is covered with oilcloth $1\frac{1}{2}$ yd. wide at 75¢ a running yard. Required the cost, if the room is 18 ft. square.

16. A church floor measuring 66 by 40 ft. is to be covered with yard-wide carpeting at 90¢. What is the expense?

17. The floor of a room 16 by 18 ft. is partly covered by a rug measuring $11\frac{1}{2}$ by $12\frac{1}{2}$ ft. How many square feet of floor are uncovered?

18. How many yards of matting 1 yd. wide will be required for 3 rooms in my seaside cottage? The largest is 15 by 18 ft., the smallest is 10 by 12 ft., and the other is 12 ft. square.

19. How many tiles 8 in. square will be required for a vestibule measuring 10 ft. by 8 ft.?

Required the cost of carpeting rooms of the following dimensions, with ¾ carpeting, at $1.50 a yard, no allowance for matching: —

20. 18 ft. by 15 ft. **22.** 12½ ft. by 11¼ ft. **24.** 17½ by 13½ ft.
21. 22 ft. by 17 ft. **23.** 19 ft. by 18 ft. **25.** 15¼ by 13½ ft.

26. The parallel sides of a trapezoid are 25 and 37 ft., respectively, and the distance between them is 15 ft. Required the area.

27. The base of a triangle is 17½ in., its altitude 8½ in. What is its area?

28. A lot of land has a frontage of 50 ft. One side of its parallel sides measures 10 rd. and the other 80 ft. How many square feet?

29. The diagonal of a trapezium is 14 in. The altitudes perpendicular to it measure 6 in. and 8 in. What is the area of the trapezium?

30. A triangular park measures 600 ft. on one street and 300 ft. on the other at right angles to it. How many square rods in the park?

31. Compare the area of a rhombus having a base of 15 ft., and an altitude of 12 ft., with that of a 14-ft. square.

32. The diagonal of a trapezium is 42 in., and the perpendicular dropped to it from the angles are 16 in. and 18 in. Required the area.

33. What is the area of one of the triangles into which the diagonals of a field 10 rd. square divide it?

34. What will it cost to fence a yard in the shape of an equilateral triangle 36 ft. long with 4 lines of wire weighing one pound to every 20 ft. and costing $3\frac{1}{2}$¢ a pound? There are 12 posts, costing 15¢ each.

35. How does a 3-in. cube compare with a 6-in. cube in weight?

36. If a cubic foot of granite weighs 165 lb., what will a cube of granite measuring 6 in. weigh?

37. How many bushels of oats will a bin 20 ft. long, 10 ft. wide, and 8 ft. deep contain, if a cubic foot $= \frac{8}{10}$ of a bushel?

38. A schoolroom 12 ft. high, 30 ft. long, and 28 ft. wide contains 40 pupils. How many square feet of floor space for each pupil? How many cubic feet of air for each one?

39. What shall I pay for a pile of 4-ft. wood 15 ft. long and 6 ft. high at $6.50 a cord?

40. A cubic foot of mahogany weighs 45 lb. What will be the weight of a piece of mahogany 5 in. thick, 20 in. wide, 16 ft. long?

41. A telephone pole is 30 ft. long, and averages 10 in. square. What does it weigh, at $41\frac{1}{4}$ lb. to the cubic foot?

42. Find the cost of this bill of lumber at $22 per M: —

48 pieces 2 × 4 and 18 ft. long.
23 joists 2 × 10 and 15 ft. long.
20 joists 2 × 8 and 18 ft. long.

43. If an inch of rain fell during a shower, how many cubic feet of water fell on $1\frac{1}{2}$ A. of ground?

44. How many bricks will be required to lay a 16-in. wall 40 ft. long and 12 ft. high, if 22 bricks equal a cubic foot?

45. A room measures 22 ft. × 19 ft. The carpet is one yard wide, costs $1.10, and the strips run in the most economical way. What is the cost of carpeting?

46. My dining room measures 16 ft. × 14 ft. It is partly covered by an art square measuring 11 ft. × 13 ft. What will it cost to dress the portion of the floor that is exposed, at $5\frac{3}{8}$¢ per square foot?

47. A box measuring 32 × 8 × 7 ft. is $\frac{7}{8}$ filled with shelled corn. It weighs 56 lb. to the bushel, and there is $\frac{8}{10}$ of a bushel in every cubic foot. What is the value of the corn at 75¢ a bushel?

48. A car 36 ft. long and 8 ft., 6 in. wide, loaded to a depth of 5 ft., contains how many bushels of wheat? (1 cu. ft. = 0.8 bu.) What is the weight of the load, at 60 lb. per bushel?

49. How much paint will it take to cover the outside of a railroad water tank, including top and bottom, if the tank is 26 ft. in diameter and 14 ft. high, allowing 2 qt. of paint per square (100 sq. ft.)?

50. A locomotive is extended 3 ft. in order to gain heating surface and thus increase the steaming capacity. If there are 375 2-inch tubes, by how many square feet is the heating surface of the tubes increased?

51. Find the pressure tending to blow the head out of an air drum 16 in. in inside diameter when the gauge shows a steam pressure of 90 lb. per square inch.

52. A drumhead 26 in. in diameter is cut from a sheet of $\frac{1}{2}$-in. steel plate 27 in. square. Find the weight of the portion cut off. ($\frac{1}{2}$-in. plate weighs 20.4 lb. per square foot.)

53. A car 36 ft. long and 8 ft., 6 in. wide contains 1000 bu. of wheat. If the wheat is leveled off, how high does it reach in the car? (1 cu. ft. = 0.8 bu.)

54. A box car is 36 ft. long, 8 ft., 6 in. wide, and 8 ft. high. What weight of oats will it carry if it is filled? (Oats weigh 32 lb. per bushel.)

55. To what depth may the car described in Problem 54 be filled with wheat, not to exceed its capacity of 80,000 lb.? (1 bu. weighs 60 lb.)

56. Can the same car be filled with Syracuse salt, weighing 56 lb. per bushel?

57. What is the greatest weight of grass seed that the same car will carry? (1 bu. weighs 14 lb.)

58. A track tank 1450 ft. long and 19 in. wide, filled to an average depth of $4\frac{3}{4}$ in., contains how many gallons of water?

59. How many pounds of iron does a founder need to melt to make a shaft 16 ft. long and 6 in. in diameter, if a cubic foot weighs 450 lb.?

60. The cylinder of a pumping engine is 5 ft. long and 16 in. in diameter. If it makes 18 single strokes per minute, how many gallons will it pump in a day?

61. How many tons of cast iron in a water main 578 ft. long, 8 in. outside diameter, and 7 in. inside diameter, if a cubic inch weighs 0.2607 lb.? With a velocity of 96 ft. per minute, how many gallons of water could it discharge per hour? How much would the pipes cost at $2\frac{1}{2}$¢ per pound?

62. A circle is 10 ft. in diameter. How many degrees in an arc of it 16 ft. long?

63. Two places on the equator are 500 mi. apart. Find their difference in longitude. (Call the earth's diameter 8000 mi.)

64. A circular duck pond contains 1963.5 sq. yd. How many square feet of wire netting $3\frac{1}{2}$ ft. wide will it take to inclose it?

65. A tank is 15 m. long, 10 m. wide, and 3.5 m. deep. How many liters will it contain?

66. The internal diameter of a cylindrical bucket is 18 in. It will hold 248 lb. of water. How deep is it?

Ratio — Written Problems

1. Dorothy is 18 yr. old. Her father is 54. How much older is he than his daughter? What part of his age is hers? How many times as old is the father?

2. Her grandmother is 72 yr. old. Compare their ages.

3. Which gives you the clearer idea of the relative value of two books, to say that the first cost $\frac{1}{3}$ as much as the second, or to say that the second cost 3 times as much as the first?

Give the ratio of the following quantities: —

4. 4 in. and 12 in.
5. 2 bbl. and 18 bbl.
6. 42 gal. and 7 gal.
7. 46 bu. and 4 bu.
8. $8 and $64.
9. 1 ft. and 1 yd.
10. 1 bu. and 1 qt.
11. $\frac{1}{2}$ mi. and 2 mi.
12. 2 sq. in. and 1 sq. ft.
13. 2 cu. ft. and 2 cu. yd.
14. $\frac{3}{4}$ hr. and $3\frac{3}{4}$ hr.
15. 0.06 and 0.24.
16. $5.70 and $1.90.
17. 21 da. and 30 da.
18. 1° and 1′.
19. $17\frac{1}{2}$ and $52\frac{1}{2}$.
20. 1 yd. and 1 rd.
21. $66\frac{2}{3}$% and $16\frac{2}{3}$%.
22. 35 : 84.
23. 189 : 81.
24. 225 : 120.
25. $\frac{7}{8}$: 10.
26. $\frac{5}{6}$: $2\frac{1}{3}$.
27. 150 : $16\frac{2}{3}$.
28. 6 in. : 2 yd.
29. 1 lb. : 4 oz.
30. $5\frac{1}{4}$: 14.
31. 2.5 : 62.5.
32. 75¢ : $6.
33. 16 hr. : 16 da.
34. 160 bbl. : 48 bbl.
35. 120 mi. : 360 mi.
36. 129 : 215.
37. 60 pk. : 3 bu.
38. $34\frac{1}{2}$: $5\frac{3}{4}$.
39. 24.6 : 123.
40. $\frac{9}{10}$: $\frac{3}{10}$.
41. $\frac{1}{8}$: 4.
42. $\frac{2}{5}$: $\frac{3}{4}$.
43. 45 : 70.
44. 36 : 45.
45. 10 : 25.
46. $\frac{5}{7}$: $\frac{10}{14}$.
47. $2\frac{1}{2}$: $\frac{1}{4}$.
48. 5 : $\frac{1}{3}$.
49. 105 : 195.
50. 256 : 112.
51. 81 : 216.
52. 3 lb. : 2 oz.
53. 1.44 : 3.2.
54. 108 : 63.
55. 84 : 35.
56. 15 ft. : 1 mi.
57. 11 ft. : 15 rd.
58. 6.5 : 14.3.
59. $256 : $228.
60. 1 qt. : $7\frac{3}{4}$ gal.

Proportion — Written Problems

1. Mention several couplets that have the ratio of $12 : 8$.

ORAL

Test the proportions by seeing whether the ratios are equal: —

2. $3 : 24 = 5 : 40$.

3. $16 : 4 = 48 : 12$.

4. $5 : 3 = 70 : 40$.

5. $3\frac{1}{2} : 7 = 5\frac{1}{2} : 11$.

6. 1 ft. : 9 in. = 1 yd. : 2 ft.

7. $\frac{2}{3} : \frac{3}{4} = 16 : 18$.

8. 3 yd. : 4 yd. = \$1.50 : \$2.

WRITTEN

Find the missing term in these proportions: —

9. $x : 16 = 130 : 26$.

10. $324 : 243 = 12 : x$.

11. $\frac{1}{2} x = 8 : 16$.

12. $\$x : \$18 = 60 \text{ lb.} : 54 \text{ lb.}$

13. $10 \text{ T.} : \frac{1}{2} \text{ T.} = \$x : \$\frac{3}{75}$.

14. $9\frac{1}{2} : 16\frac{1}{4} = 38 : x$.

15. $7.25 : 0.5 = x : 3$.

16. In a proportion, the value of the first ratio is $3\frac{5}{16}$. What is the value of the second ratio?

17. In the first ratio of a certain proportion, the consequent is $\frac{3}{8}$ of the antecedent. What relation do the terms of the second proportion bear to each other?

18. When 12 bu. of potatoes cost \$7.50, what will 36 bu. cost? What is the ratio of 36 to 12? What is the ratio of the cost of 36 to the cost of 12? Of the weight of 36 bu. to the weight of 12 bu.?

19. What is the ratio of 14 to 56? If 14 T. of straw cost \$65, how much will 56 T. cost?

20. What is the ratio of 17 to 85? Find the cost of 85 yd., when 17 yd. cost \$1.25.

21. What is the ratio of 19 to 114? If 19 gal. of alcohol cost \$72, what will 114 cost?

If you have divided \$72 by 19 and multiplied the quotient by 114, you have wasted your time. There is a shorter way.

22. What is the ratio of 18 to 162? If a bicyclist runs 18 mi. in 2¼ hr., how long will he require to cover 162 mi. at the same rate? Can you solve the problem without a pencil?

23. If 13 cars will carry 275 T. of coal, how many tons will 91 cars carry? What is the ratio of 91 to 13?

24. How do you find the missing term of a proportion?

25. When the third term is larger than the fourth, will the first ratio of the proportion be greater or less than one?

26. When $120 is paid for 15 bbl. of flour, what shall be paid for 79 bbl.?

27. $5.88 purchases 7 gal. molasses. At the same rate, what will 27 gal. cost?

28. A yachting party sails 319 mi. in 11 da. At the same rate, how far will it travel in a 47-day trip?

29. Two men purchase a schooner. One furnishes 13 parts of the purchase money, and the other furnishes 17 parts. They sell it at a profit of $960. They quarrel over the division of it. Divide it equitably.

30. Two friends agree to share the expenses of an outing trip in the ratio of 3 : 5. The expenses are $24. What ought each to pay?

31. Divide $100 between two men in the ratio of 7 : 3.

32. The value of the first ratio of a proportion is $\frac{3}{5}$. The antecedent of the second ratio is 18. What is the consequent? What is the whole proportion?

33. The ratio of two steamers, as to speed, is 7 : 8. If the faster one makes 16.8 knots an hour, what does the slower one make?

34. What is the ratio of an arc of 40° to the circumference?

35. The ratio of an hour to a day is the same as the ratio of a month to what?

36. What is the ratio of a square foot to a square yard? What is the ratio of 2 sq. ft. to 2 sq. yd.? What is the ratio of 3 sq. ft. to 3 sq. yd.?

37. Compare a floor 10 ft. square with one 12 ft. square. If it costs $25 to carpet the smaller room, what will it cost to carpet the larger one at the same rate?

38. Two partners share the year's profits of $1500 in the ratio of 7 : 8. What is the difference between their shares?

39. If the following proportion is not correct, make it so by changing one of its terms. As, 3 : 7½ : : 4 : 10.

40. What effect does it have upon a proportion to multiply the first couplet by 3? To multiply the two antecedents by 4? To divide the two consequents by 7?

41. If 36 yards of carpet must be bought for a floor when the width of a strip is 36 inches, how many yards are required when the strip is 27 inches wide?

42. A cog-wheel having 8 cogs plays into another having 24 cogs. When the small wheel has made 42 revolutions, how many has the larger wheel made?

43. If a block of marble weighs 6930 lb., and is 7 ft. long, 3 ft. wide, and 2 ft. thick, what will a block 10 ft. long, 4 ft. wide, and 3 ft. thick weigh?

44. If a bin 12 ft. long, 4½ ft. wide, and 7½ ft. deep holds 324 bushels of grain, how many bushels will a bin 16 ft. long, 5 ft. wide, and 6½ ft. deep hold?

45. If $240 are paid for building a wall 75 ft. long, 10 ft. high, and 1½ ft. thick, at the same rate how much should be paid for building a wall 90 ft. long, 12 ft. high, and 1½ ft. thick?

46. A father divides his estate between two sons, giving the younger ⅗ as much as the elder. The estate was valued at $40,000. What did each receive?

PART III

MISCELLANEOUS PROBLEMS AND EXAMINATION QUESTIONS

CHAPTER VIII

GENERAL MISCELLANEOUS PROBLEMS

1. What will $12\frac{3}{4}$ cd. of wood cost when $4\frac{1}{4}$ cd. cost $34? (Solve a short way.)

2. How many tiles 8 in. square in a floor 24 ft. by 36 ft.? (Solve a short way.)

3. A merchant bought gasoline at 14 ct. a gallon, and retailed it at 18 ct. What per cent did he make if he lost 5% by evaporation?

4. What is the cost of a pile of 4-ft. wood 28 ft. long and 6 ft. high at $7.50 per cord?

5. A man has three $4\frac{1}{2}$% $1000 bonds and five 4% $500 bonds. What yearly interest does he receive from them?

6. Find the depth of a cylindric tank 5 ft. in diameter that has the same capacity as a rectangular cistern 8 ft. square and 6 ft. deep.

7. A map is so drawn that an inch represents $\frac{8}{10}$ of a mile on the surface of the earth. How many acres of land are represented by a portion of the map 3 in. square?

8. A sea captain sailed from London with Greenwich time. On a certain day he observed that his chronometer had gained 2 hr., 45 min., 30 sec., compared with the sun. Find his longitude at the time of the observation.

9. The parallel sides of a trapezoid are 18 ft. and 16 ft., and its altitude is 9 ft. Find its area.

10. The base of a triangular lot of land is 525 ft. and the altitude is 80 ft. Find the cost of the land at 5 cents per square foot.

11. If it cost $30 to paint the outside of a house 40 ft. long, 30 ft. wide, and 25 ft. high, what will it cost to paint the outside of a house 50 ft. long, 40 ft. wide, and 20 ft. high? (Use a short method.)

12. A certain town is taxed $10,999. The real estate of the town is valued at $500,000 and the personal property at $300,000. There are 666 taxable polls, each assessed $1.50. What is one's tax whose real estate is valued at $4000 and personal property at $8000, and who pays a poll tax?

13. To every 6 gal. of milk 4 qt. of water are added. Find the value of a pint of the mixture, pure milk being worth $3\frac{1}{2}$¢ a pint.

14. Find in kilograms the weight of the water that may be contained in a cylindric cistern 1.8 m. in diameter and 1.4 m. deep.

15. State and explain the relation of time to longitude. Explain standard time.

16. At what rate will $656.50 amount to $748.41 in 3 yr., 6 mo.?

17. A man bought and sold stock, thereby gaining $12\frac{1}{2}$%; the stock sold at $99\frac{1}{8}$. Find the market quotation of the stock at the time of the purchase, brokerage in each case being $\frac{1}{8}$%.

18. What is due Jan. 16, 1911, on a note of $1600 drawing 6% interest, given May 3, 1907, the following payments having been made: May 3, 1908, $200; Dec. 18, 1908, $80; June 25, 1909, $300; April 16, 1910, $450?

19. How many sacks, holding 2 bu., 3 pk., 2 qt. each, can be filled from a bin containing 734 bu., 2 qt.?

20. Fill blanks with missing terms: (*a*) $\frac{1}{5} : \frac{1}{10} = \frac{1}{7} : ?$ (*b*) $7 : ? = 20 : \frac{1}{5}$.

21. What is the ratio of a nickel to a dollar? Of a yard to a foot? Of a quart to a bushel?

22. Divide the number 108 into two parts which shall be to each other as 5 to 1.

23. What sum will be required on June 22, 1911, to pay a note of $1000, given Jan. 1, 1908, with interest at 5%?

24. Find cost of 1185 lb. of hay at $19.50 per ton.

25. Find cost of 275 ft. of lumber at $47 per M (thousand).

26. A house and lot cost $5000. The insurance is $25, taxes are $50, and repairs $75 annually. What rent must be received in order to realize a net 6% on the investment?

27. At 35 ct. per cubic yard find the cost of excavating a trench 6 rd. long, $1\frac{1}{2}$ yd. wide, and 1 ft., 6 in. deep.

28. Two successive discounts of 15% and 10% reduced a bill to $489.60. What was the original bill?

29. The price of gas is 11 cents per hundred cubic feet, with a discount of 20% if paid within 5 days of the end of the month. My meter reading at the end of May was 67,300 cu. ft. The April reading was 64,800 cu. ft. I paid my May bill June 2. What sum did I pay?

30. A garden 145 ft. long and 120 ft. wide is surrounded by a tight board fence 6 ft. high. At 8 ct. a square yard, find the cost of painting both sides of the fence.

31. From a sheet of gold leaf 6 in. square a 6-in. circle was cut. How many square inches of the sheet remained?

32. The extremes in a given proportion are $9\frac{3}{8}$ and $3\frac{5}{9}$, and the second mean is $4.16\frac{2}{3}$; required the first mean.

33. A man's holdings in U.S. 4's bring him an annual income of $1000. If he bought his stock at a 10 % premium, what did it cost him, brokerage $\frac{1}{8}$ % ?

34. What is due July 23, 1910, on a note of $2400 drawing 5 % interest, given Jan. 4, 1905, the following payments having been made: Sept. 4, 1905, $300; July 19, 1906, $50; Jan. 4, 1907, $300; April 16, 1908, $250; Dec. 26, 1909, $500?

35. A note of $3500, dated Aug. 15, 1907, interest 6 %, has the following indorsements: Aug. 15, 1908, $500; Feb. 15, 1909, $100; July 10, 1909, $400; Dec. 15, 1909, $1500. What is due Aug. 15, 1910?

36. A cylindric vessel 14 in. high holds 2 cu. ft. of water. What is the diameter of its base?

37. The contents of a cubic wooden packing case is 42$\frac{7}{8}$ cu. ft. How many board feet are there in the six sides of this case?

38. A cubic foot of water weighs 62$\frac{1}{2}$ lb. What is the pressure per square inch at the bottom of a standpipe 40 ft. high?

(It equals the weight of the column of water whose base is a square inch.)

39. Find the proceeds of a six months note for $2000 with interest at 4 %, dated March 15, 1909, discounted at a bank June 24, 1909, at 6 %.

40. In a school district valued at $967,228 a tax of $5762.64 is to be raised. If a man's assessment is $1700, find the amount he should pay the collector, including 1 % fees.

41. A man gave a 6 % mortgage for $500, April 1, 1908. April 1, 1909, he paid $200; Oct. 1, 1909, $150; April 1, 1910, $100. Find the amount due Aug. 8, 1910.

42. A globe is 6 dm. in diameter; find the diameter of another globe of half the volume.

43. What fraction of a round log of uniform thickness is the largest squared stick which can be cut out of it?

44. If the diameter of the driving wheels of a locomotive is 2.4 meters, how many revolutions will the wheels make in running 5.3 kilometers?

45. If a coal dealer buys coal at $5 a ton of 2240 lb., and sells it at $6 a ton of 2000 lb., what is his per cent profit?

46. A note for $1575, with interest at 4%, was given Aug. 15, 1909; $250 was paid on the note Jan. 15, 1910, and $100 May 1, 1910. How much is due on the note Dec. 20, 1910?

47. A farmer has a herd of 12 dairy cows that average 22 lb. each of milk per day. The milk tests 3.8% butter fat, and butter fat is worth 28 cents per pound. What is the daily income from the herd?

48. A field of 30 A. yields 25 bu. of wheat per acre. The wheat is sold for 90 ct. per bushel. The cost of growing and marketing the crop is $225. What is the net profit from the crop? What sum placed at 6% interest would yield the same profit?

49. Find correct within one inch the height of a point on the side of a house that will be reached by a ladder 30 ft. long, when the foot of the ladder is placed 8 ft. from the building.

50. The surface of a pond contains 3 A. of commercial ice. The water is frozen so that the ice is 15 in. thick. If ice is 0.93 as heavy as an equal volume of water, find the weight of the crop of ice in tons.

51. A cylindrical water tank is built to hold exactly 220 gal. The height of the tank is 6 ft. What is the diameter in inches?

52. A man wishes to put a water tank in his attic. The tank is 28 in. long, 24 in. wide, and allows 20 in. for the depth of the water. How many gallons will the tank hold?

53. Find the duty on an importation of $4866 at an *ad valorem* rate of $8\frac{1}{8}$%.

54. An importer pays $975.50 at the customhouse, the rate being $16\frac{2}{3}$% *ad valorem.* What was the amount of the invoice?

55. A note of $7500, dated May 3, 1905, interest 5%, has the following indorsements: May 3, 1906, $2500; Aug. 3, 1906, $3500; Feb. 18, 1907, $50; May 3, 1907, $500. What is due May 3, 1908?

56. A 30-da. note, dated March 1st for $500, is discounted 12 da. after its date, at 6% for the unexpired time. What are the proceeds?

57. A man sold 3150 bu. of grain and had 30% of his entire crop left. What was his entire crop?

58. Find the cost of lining a tank 5 ft., 8 in. long, 4 ft. wide, and 5 ft. deep with zinc, weighing 5 lb. to the square foot, at 12 cents a pound.

59. Find the duty on 50 pieces of matting, 48 yd. in a piece, invoiced at 38¢ a yard, duty 16¢ a yard, and 30% *ad valorem.*

60. An invoice of English suitings was £138. What was the duty at 32% *ad valorem,* calling the value of a pound $4.90?

61. A merchant imports 65 doz. gloves valued at 36 francs a dozen. What is the duty at 25% *ad valorem,* the value of a franc being $0.193?

62. What is the duty on 1000 yd. of Brussels carpet 27 in. wide, invoiced at 5*s.* per yard, duty 44¢ per square yard specific, and 35% *ad valorem?*

63. How many cubic yards of earth would have to be removed to lower the grade of a street 15 in., the street being 20 rd. long and 60 ft. wide?

64. A house cost $5500. The average annual necessary expenditures are: repairs, $120; taxes, $52; insurance, $12.50. The house rents for $35 a month. What per cent, net, does the owner realize on his investment?

65. At $54 per M (thousand), find the cost of a board 18 ft. long, 16 in. wide, and $1\frac{1}{4}$ in. thick.

66. Find the ratio of 2 lb. 4 oz. to $4\frac{1}{2}$ lb.

67. I marked some goods at 40 % above cost, sold them at 25 % less than the marked price, and gained $185. What was the cost of the goods?

68. An invoice of woolens from England was valued at £500. The net weight was 600 lb. What was the duty at 50¢ a pound specific, and 30 % *ad valorem?*

69. I wish to send $973.30 to Liverpool. What will a draft cost if exchange is selling at $4.85?

70. Imported 960 m. of silk at 4 francs a meter. Find the duty, specific at 20¢ a yard, and 25 % *ad valorem.* Take franc at par, and call the meter 39.37 in.

71. The duty on an importation is $22\frac{1}{2}$ % *ad valorem.* $183.75 is the cost, including the duty. What was the amount of the invoice?

72. What is the duty, at $2\frac{1}{2}$¢ a pound, on 800 boxes of figs, weighing 110 lb. each, tare 10 %?

73. A town whose property is valued at $5,400,000 levied a tax of $67,500. What does a man pay whose real estate is valued at $12,000, and personal property at $5600?

74. What annual income will one receive from $81,750 invested in $4\frac{1}{2}$ % bonds at $108\frac{7}{8}$, brokerage $\frac{1}{8}$ % ?

75. A note of $6500 to run one year, dated June 12, 1909, bearing $5\frac{1}{2}$ % interest, was discounted March 20, 1910, at 6 %. Find the proceeds.

76. A man sold his house and lot through an agent, for 15 % more than they cost. The agent's fee was 5 %. What did the house cost if the owner received $10,378.75 clear of the agent's fee?

77. A man sold five $1000 4½ % bonds at 103½, through a broker, and loaned the proceeds at 5 % interest. By how much was his income increased?

78. A note of $7500 dated June 16, 1908, bearing 6 % interest, has the following indorsements: —

Jan. 16, 1909, $500; Aug. 10, 1909, $600; Dec. 1, 1909, $1500. How much was due July 16, 1910?

79. The par value of some 4½ % bonds is $8500. What yearly interest do they pay, and what is their market value at 105¾?

80. A man has a claim of $15,775 against a corporation. He pays a collector 5 % of the amount collected. What is his total loss, including the collector's fee, if but 65 % of it is collected?

81. By selling goods for $4176, my gain was 20 %. By selling them for $3132, what would my per cent of loss have been?

82. A collector's commission at 2½ % was $135. How much did he turn over to his principal?

83. I bought goods at a discount of 33⅓ %, and 10 % from the list price, and sold them at a discount of 25 % from the same list price. What per cent did I make?

84. A dealer bought 600 tons of coal at $5 per ton and sold it at a gain of 25 %. Find his net profit if he loses 3 % in bad debts and is out $120 for freight, delivery, etc.

85. A note of $4500, dated May 15, 1908, bearing 5½ % interest, has the following indorsements: May 15, 1909, $600; July 10, 1909, $50; Dec. 24, 1909, $1.50. Find what is due June 10, 1910.

86. Find the selling price of goods listed at $1150, discounts 33⅓ % and 10 %, sold at a profit of 40 % on the net cost.

87. If I invest $56,912.50 in 4 % bonds at 98, brokerage ⅛ %, what is my annual income from them?

88. What is the duty on 1150 yd. of silk invoiced at $1.08⅓, at 45 % *ad valorem?*

89. A bin 8 ft. long, 6 ft. wide, and 5 ft. deep contains 150 bu. of oats. What per cent of the bin is filled?

90. A total tax of $383,780 is raised in a town having 1015 polls each assessed at $2. The assessed valuation of the property is $25,450,000. What is the tax rate upon the property?

91. If I buy goods at 30 % discount from the list price, what discount can I give from the same list price to make 20 %?

92. A rope 73 ft. long is fastened to the top of a boat's mast, and when drawn taut, it touches a point on the deck 55 ft. from the foot of the mast. Find the height of the mast.

93. The area of a circular garden is 12.5664 sq. rd. What is the diameter of the garden?

94. Find the altitude of a pyramid of which the volume is 84 cu. ft. and the base is a square 6 ft. on a side.

95. The composition of one kind of Babbitt's metal is 4 parts copper, 8 parts antimony, and 88 parts tin. Find the amount of each material necessary to produce 175 lb. of the metal.

96. Give the relation between the carrying capacities of one 8-inch pipe and two 4-inch pipes when each of the pipes discharges water with a velocity of 75 ft. per minute.

97. Square pieces of tin, 8 in. on a side, are fed to a stamping machine which has 4 dies cutting out four of the largest possible circular pieces of tin. What is the area of each disk?

98. A bar of zinc 27 in. long, 2¼ in. wide, and 1½ in. thick is melted into the form of a cube. Find its dimensions.

99. Find the heating surface of the 291 tubes of a locomotive when each tube is 19 ft., 6 in. long and 2½ in. in diameter.

CHAPTER IX

RECENT EXAMINATION QUESTIONS

NOTE. The following are sets of examination questions given by some of the leading schools of the country. They are practically unchanged, except that they have been "cut down" to ten each.

I

1. At \$$2\frac{5}{8}$ a cubic foot, what is the cost of a block of marble 8 ft., 2 in. long, 4 ft., 8 in. wide, and 2 ft., 6 in. thick?

2. If 1 A. of land produces 32 bu., 3 pk. of wheat, how much will 27 A. produce at the same rate?

3. (*a*) The sum of two fractions is $1\frac{5}{13}$; one of the fractions is $\frac{5}{7}$. What is the other fraction?

(*b*) The product of two fractions is $\frac{15}{63}$; one of the fractions is $\frac{3}{7}$. What is the other fraction?

4. How many lots, each containing 4 A., 36 sq. rd., can be formed from 50 A., 112 sq. rd.?

5. If $\frac{5}{7}$ of a building is worth \$8795, what is $\frac{3}{8}$ of the remainder worth?

6. The commission for selling some property was \$985. If the rate was 5%, find the value of the property sold.

7. A house is worth \$6480. It is insured for $\frac{2}{3}$ of its value at $\frac{3}{4}$%. What is the premium?

8. A man sold an article for \$24, and lost 25%. If he had sold it for \$34, what per cent would he have gained or lost?

9. In a certain school 46 % of the pupils are boys, and there are 351 girls. Find the number of boys.

10. Find the amount of $725 from Aug. 8, 1907, to July 22, 1910, at 6 %.

II

1. A firm had $\frac{1}{4}$ of its capital invested in goods, $\frac{2}{3}$ of the remainder in land, and the remainder, $1224, in cash. What was the capital of the firm?

2. At $3 a day, what is earned by a man who works half a day, $\frac{5}{6}$ da., $\frac{3}{4}$ da., and $2\frac{3}{8}$ da.?

3. (*a*) $2.1952 \div 0.028$.

(*b*) Change to decimal form $\frac{17}{20}$; $\frac{3}{8}$; $\frac{9}{16}$.

4. A farmer sold 24 doz. eggs at $22\frac{1}{2}$ ct. a dozen, and 12 lb. of butter at $27\frac{1}{2}$ ct. a pound. He was paid in tea at 37 ct. a pound. How many pounds of tea should he receive?

5. How many cords of wood can be piled into a shed 20 ft. long, 18 ft. wide, and 16 ft. high?

6. What will it cost to paint the walls and ceiling of a hall 48 ft. long, 27 ft. wide, and 18 ft. high, at a cost of $1.20 per square yard, no allowance being made for doors or windows?

7. If gunpowder contains 75 % of saltpeter, 10 % of sulphur, and 15 % of charcoal, how many pounds of each are there in a ton of powder?

8. A girl who attended school 68 da. during a term was marked 85 % for attendance. How many days was she absent?

9. Find the interest of $767.80 for 3 yr., 11 mo., 9 da. at $5\frac{1}{2}$ %.

10. A merchant having a debt due him of $6424 agrees to accept 80 % of the amount due. What will he receive if he pays his agent $2\frac{1}{4}$ % for collecting the money?

III

1. A grain elevator had a bin 7⅛ ft. square and 80 ft. deep. How many bushels did it hold, allowing 1¼ cu. ft. to the bushel?

2. At what price per dozen pair must I buy gloves to retail them at $1.25 a pair and realize a profit of 20%?

3. A note for $650 at 4% simple interest was given Dec. 12, 1909. Find amount of this note to date.

4. A dealer bought goods at 20% less than market value, and sold them at 20% above the market value. What per cent did he gain?

5. A town wishes to raise by taxation $206,200. It is estimated to contain 9115 persons subject to a poll tax of $1 each. Its assessed valuation is $23,462,500. What will be the rate of property tax?

Find the amount of Mr. Brown's tax if the assessed valuation of his property is $8500.

6. If an agent receives 2½% for collecting, and is paid $739, how much will his employer receive?

7. If the premium on a policy is $19.50 and the rate is ½%, what is the face of the policy? If it is insured at ¾ of its value, find the value of the property.

8. Find the proceeds of a 90-da. note for $1575, dated Aug. 1, and discounted Aug. 18, at 4%.

9. A boy buys apples at the rate of 5 for 2 ct., and sells them at the rate of 8 ct. a dozen. How many apples must he buy and sell in order to gain $2?

10. A 50-ft. ladder leans against a wall with the foot 14 ft. from the base of the wall. Draw a sketch and compute the height from the ground of the upper end of the ladder.

IV

1. Add the following: —

Sixty eighty-firsts and seventeen eighteenths.

2. If a train runs $\frac{1}{3}$ of a certain distance in 1 hr., what part of the distance can it run in 45 min.?

3. Reduce $\frac{\frac{5}{3}}{\frac{7}{8}}$ to its simplest form.

4. Divide 60 by 0.6.

5. A man bought 83 sheep at $6 each and sold them at a profit of 15%. How much did he gain?

6. A dealer sold a bicycle for $24.50, which was 30% less than the marked price. What was the marked price?

7. If $\frac{3}{4}$ A. of land costs $90, how much will $\frac{7}{8}$ A. cost?

8. Find the interest of $325 for 1 yr., 8 mo., 5 da. at 5%.

9. How many square yards of oil cloth are needed for a kitchen 15 ft. by 21 ft., allowing 5% more than the area for matching?

10. $0.85 is 2% of what sum?

V

1. Define a unit; a number; a concrete number; an abstract number; a fraction.

2. (*a*) What is the difference between a factor of a number and a root of a number?

(*b*) What is the difference between bank discount and simple interest?

(*c*) Describe the form of units used in measuring areas. Name them.

(*d*) How do you find the area of an equilateral triangle?

(*e*) How do you find the volume of a sphere?

3. Change $2\frac{1}{2} \times 3\frac{1}{3} \div 8$ to a decimal.

4. A workman had his wages advanced from $1.875 to $2.25 per day. Allowing 300 working days in a year, what was the annual increase in his salary?

5. By selling a horse for $140 the gain would be 12 %. To gain 28 %, for what must the horse be sold?

6. By the *six per cent method*, find the amount of $5670 for 1 yr., 11 mo., 27 da., at $4\frac{1}{2}$ %.

7. A 4-mo. note, $1200, dated June 5, 1909, is discounted at a bank July 15, 1909, at 5 %. What were the proceeds?

8. An agent bought flour at $5 per barrel. He received $32 as his commission at 4 %. How many barrels did he buy?

9. What is the difference in *area* and in *circumference* between a 100-ft. circle and a 50-ft. circle?

10. The diagonal of a cube is 20 in. What is its entire surface?

VI

1. Divide 3.63 by 2.353, and find the square root of the quotient to three decimal places.

2. Find the area of a circle whose circumference is 40.8408.

3. The longitude of Boston is 71° 3′ 30″ W., and that of San Francisco is 122° 25′ 40″ W. When it is noon in Boston, what time is it in San Francisco?

4. I bought two farms at $4500 each and sold one for $6300 and the other at a loss of 37 %. How much did I gain or lose on both?

5. What is the difference between a discount of 45 % on a bill of $100 and three successive discounts of 20 %, 15 %, and 10 %?

6. A park is 48 rd. long and 32 rd. wide. How many times must a man walk around it to travel 90 mi.?

7. Find the amount of $375.75 for 4 yr., 5 mo., and 25 da. at $4\frac{1}{2}$% compound interest.

8. What sum must be invested in five per cent bonds, at 108, to yield an annual income of $2020.00, brokerage $\frac{1}{8}$?

9. The area of a rectangle and that of a triangle are equal. The base and the altitude of the triangle are respectively 18 ft. and 25 ft. The base of the rectangle is 5 ft. What is its altitude?

10. My agent has bought 585 bbl. of flour at $6.50 per barrel. His commission is $2\frac{1}{2}$%. How much must I remit to him to pay the cost of the flour and the commission?

VII

1. Which is the better way of buying flour — by the barrel (196 lb.) for $5.75, or the same amount at $3\frac{1}{2}$ct. a pound?

2. Find $\frac{3}{5}$ of $3\frac{1}{3}$.

3. At the rate of a mile in 4 min., how far will an automobile go in 3 hr.?

4. Divide 888.16 by 2.8.

5. A man invested $1750 and lost $192.50. What per cent did he lose?

6. A merchant bought 2000 yd. of silk at $87\frac{1}{2}$ ct. a yard. He marked it $1.10 a yard and sold 950 yd. at that price. He then sold 750 yd. at 10% off, and the rest at 50% off. Did he gain or lose on the lot, and how much?

7. Find the interest of $163.40 for 3 yr., 9 mo., 15 da. at $5\frac{1}{2}$%.

8. There is a pile of wood by the road. What is necessary to find the number of cords it contains?

9. A room measures 18 ft. long, 12 ft. wide, and 10 ft. high. At 37 ct. a square yard, find the cost of plastering it, no allowance being made for doors and windows.

10. Express ⅛ of ⅗ decimally.

VIII

1. A trader sold 120 horses for $14,400, thereby gaining $2400. If he had sold them at $130 a head, what would have been his gain per cent?

2. Find the proceeds of a 3-mo. note for $875, dated Dec. 12, 1909, and discounted Jan. 10, 1910, at 5 %.

3. Mr. G. H. Smith bought of Hammett, Brown, & Co., April 7, 1910, 2 lb. veal at 16 ct., 3 lb. sirloin steak at 25 ct., 2½ lb. ham at 12 ct., 2¼ lb. chops at 20 ct.; April 21, 5 lb. chops at 20 ct., 3 lb. tenderloin steak at 30 ct. Make out the bill.

4. Find the interest of $1960 for 3 yr., 5 mo., 21 da. at 7 %.

5. The list price of an invoice of hardware was $8750, but the discounts were 20 % and 10 %. What was the cost?

6. If I invest $5280 in stock at 131⅞, brokerage ⅛ %, paying a dividend of 5 %, what will be my annual income?

7. Find the cost of plastering a room 16 ft. long, 14 ft. wide, 10 ft. high, at 25 cents a square yard.

8. When it is two o'clock at longitude 2° 20′ 22″ E., what is the longitude of a place where the time is six minutes past two?

9. A man sold his farm for $3400, which was a gain of 33⅓ %. What would have been his gain per cent if he had sold it for $2754?

10. The top of a pupil's desk measures 2 ft. by 20 in. What is the length of a line drawn from one corner to the diagonally opposite corner?

IX

1. What are taxes? How many and what kinds are there? Name five ways in which the tax money is spent so that you personally enjoy the benefit.

2. Mr. Brown's house is assessed $9500. The rate of taxation is $16.40 on a thousand. What is Mr. Brown's tax?

3. Which is the greater discount — 35 % off, or 25 % and 10 % off? Why? Why are discounts given?

4. Goods listed at $840 were sold with discounts of 15 % and 10 % off. Find the net cost.

5. In what time will $450 gain $192.30 at 8 %?

6. What principal will gain $76.50 in 2 yr., 6 mo. at 3 %?

7. Find the interest and amount of $2500 for 1 yr., 7 mo., and 15 da. at 7 %.

8. One year the tax rate in a city was $21.40 on a thousand, the next year it was $19 on a thousand. Find the amount saved on property assessed at $64,500.

9. Find the duty on 100 doz. knives valued at $600, when the *ad valorem* duty is 15 %, and the specific duty is 16 ct. on each knife.

10. A house costing $11,250 rents for $1200. The taxes and expenses are $300 per year. What is the annual per cent of net income on the investment?

X

1. Find the cost of a carpet 30 in. wide, at $1.25 per yard, for a room 18 ft. by 14 ft., the strips to run lengthwise.

2. A lawyer collected a debt of $1260, and charged 5 % commission on the sum collected. What did the creditor receive?

3. The product of three numbers is 792; two of the numbers are 6 and 12. Find the third number.

4. How many feet will be required for a tight board fence $5\frac{1}{3}$ ft. high, inclosing a lot 90 ft. wide, 228 ft. long?

5. A man spent $\frac{3}{7}$ of his money for a horse and $\frac{1}{7}$ for a harness. If the remainder of his money was $90, how much money had he at first?

6. How many cords of wood in a pile 40 ft. long, 3 ft. wide, and 6 ft. high?

7. How much must be paid for 3580 lb. of coal at $6.50 a ton?

8. What will it cost to dig a cellar 38 ft. long, 30 ft. wide, and 8 ft. deep at 45 ct. a cubic yard?

9. If 5 T. of hay cost $87.50, what will 21 T. cost? Explain the process.

10. What is the simple interest on $3400 for 3 yr., 6 mo. at 6 %?

XI

1. How many pounds of coffee at $33\frac{1}{3}$ ct. a pound must be given for $15\frac{1}{3}$ doz. eggs at 20 ct. a dozen?

2. The length of a rectangular field is 15 rd., 10 ft. and the width 9 rd., 8 ft. What is the perimeter of the field?

3. If each of 56 grain bags contains 2 bu., 1 pk., 4 qt., how much grain in all?

4. If $\frac{3}{4}$ of a cord of wood cost $4.50, how much will 27 cd. cost at the same rate?

5. A farm was sold for $7140, which was a loss of 15 %. What was the loss?

6. If the commission for buying goods was $1133 and the value of the goods bought $45,320, find the rate.

7. Find the tax when the value of the property is $3000 and the rate 2½ ct. on $1.00.

8. Find the amount of $875 for 3 yr., 8 mo., 15 da. at 5%.

9. I sold goods at a loss of 7%. My actual loss was $350. What was the cost of the goods?

10. Mr. Jenkins bought gloves at $4.50 per dozen pairs and sold them at 50 ct. a pair. What was his per cent gain?

XII

1. Take two hundred one thousandths from two hundred one thousand.

2. The product of three factors is 2.88. If one of them is 0.012 and another 0.06, what is the third?

3. Find the cost of digging a cellar 31 ft., 3 in. long, 24 ft., 6 in. wide, 5 ft., 4 in. deep, at 3½ ct. a cubic foot.

4. How much will it cost to carpet a room 12 ft. long and 9 ft. wide with carpet ¾ yd. wide at 95 ct. a yard? The strips run lengthwise.

5. If a single-track railroad requires 200 ties for 500 ft., how many ties will be required for 1500 ft. of a double-track railroad?

6. A man sold two houses at $5000 each. If he gained 20% on one and lost 15% on the other, find the cost of each.

7. A house is worth $4000, and the furniture $2400. The house is insured for ⅘ of its value at 2% and the furniture for ¾ of its value at 1½%. Find the premium paid.

8. Find the amount of $1634 for 2 yr., 7 mo., 21 da. at 4½%.

9. By selling goods for $46.62 a profit of 11% is made. Find the cost of the goods.

10. I received $3990 from my agent, who had deducted his commission at 5%. For what sum were the goods sold?

XIII

1. (*a*) Express with per cent sign: 0.03; $\frac{2}{8}$; $\frac{1}{400}$; $\frac{1}{20}$; seven eighths.

(*b*) Find simple interest of $880.40 for 5 yr., 6 mo. at 5%.

2. I have a wood pile 4 ft. wide, 48 ft. long, 6 ft. high. How much is it worth at $4.75 a cord?

3. A man spent $\frac{1}{2}$ of his income in living expenses, $\frac{1}{3}$ of the remainder on luxuries, $\frac{1}{2}$ of what then remained he put in the bank; the rest, $240, he paid for insurance. What was his income?

4. How much will it cost me to carpet a room 21 ft. long and 18 ft. wide with carpet $\frac{3}{4}$ yd. wide, worth $1.25 per yard? The strips are to run lengthwise, and 9 in. must be allowed on each strip for matching the pattern.

5. My coal bin is 12 ft. long, 8 ft., 6 in. wide, and 6 ft. deep. Allowing 36 cu. ft. to a ton, what will it cost at $5.50 a ton to fill the bin?

6. A car contained 36,030 lb. of wheat. What was its value at 92$\frac{1}{2}$ ct. a bushel? (A bushel weighs 60 lb.)

7. How would you find the area of a triangular field?

8. A tree is 7.854 ft. in circumference. What is the diameter?

9. A city's valuation is about $9,000,000. If the city raises by taxation $225,000, what will the tax rate be?

10. Mr. Smith bought apples for $2.50 a barrel. (2$\frac{1}{2}$ bu. in a barrel.) What must he charge for a peck in order to make 20%?

XIV

1. Give tables for dry measure and square measure.

2. Multiply 18$\frac{2}{3}$ by $\frac{3}{15}$.

3. Divide 4.57683 by 0.0123.

4. How many tons of hay could be placed in a mow 14 ft. square and 22 ft. deep, assuming that a cubic foot of hay weighs 5 lb.?

5. What would be the cost of 2660 lb. of hay at $14 per ton?

6. When a city lot 66 ft. by 132 ft. sells for $1950, what is the price per acre?

7. What is the interest of $350 for 20 months at 6%?

8. How many cords in a pile of cord wood 68 ft. long and 6 ft. high?

9. A bushel contains 2150 cu. in. How many bushels of oats could be placed in a bin 6 ft. wide, 5 ft. deep, and 12 ft. long?

10. How many tons of silage could be placed in a round silo 14 ft. in diameter and 30 ft. deep, assuming that a cubic foot of silage weighs 40 lb.?

XV

1. A man bought goods for $280. The bill for freight was $17.50. For how much must he sell the goods to make a net gain of 12%?

2. If I buy stock at 90 and sell it at 100 (no brokerage), what per cent do I gain? How many shares must I sell to gain $1000, the par value being $100 a share?

3. A horse costing $212 was sold for a note of $235, due in 60 da. I immediately got the note discounted at a bank at 5%. What was my gain? Define bank discount; proceeds.

4. In building a house I used 5400 sq. ft. of boards, which was ¾ of the quantity I purchased. How much did the boards cost at $45 per thousand?

5. Mr. Johnson deposited $240 in a bank and received a semiannual interest of $5.40. What was the yearly rate of interest?

6. If I should invest $27,000 in 4½% stock at 90, what would be my yearly income? (No brokerage.)

7. What principal will produce simple interest to the amount of $40.12½ in 1 yr., 9 mo., 12 da. at 3%?

8. Three men together bought a field 180 rd. long and 96 rd. wide, at $112 an acre. The first had 33⅓% of the land, the second 25% of it, and the third the remainder. How much did each man pay?

9. It takes 18⅔ sq. yd. of carpeting to cover the floor of a room 12 ft. wide. How long is the floor? At 8 ct. a square foot, what would it cost to plaster the ceiling of the same room?

10. I sold flour at $4.85 a barrel, retained a commission of 3%, and sent my employer a check for $3857.69. How many barrels did I sell?

XVI

1. Find the simple interest of $3840, from Oct. 13, 1908, to May 5, 1910, at 5%.

2. In what time will $480 yield $95 at 7%?

3. What is the present worth of $3200 due in 2 yr., 7 mo., 18 da., money being worth 6%?

4. A note for $1600, bearing 6% interest, dated Nov. 1, 1908, has indorsed on it the following partial payments: Feb. 1, 1909, $60; Oct. 20, 1909, $20; Nov. 1, 1909, $400. How much was due April 10, 1910?

5. A merchant imported 80 dozen razors, valued at $6 a dozen. He paid a duty of $1.75 a dozen and 20% *ad valorem*. Transportation cost $4. How much did each razor cost?

6. Which gives the lower price for a piano listed at $600 — a direct discount of 45%, or successive discounts of 25%, 15%, and 5%? How much lower?

7. I sold two houses at $4968 each, gaining 8% on one and losing 8% on the other. What did I gain or lose?

8. The amount of tax to be assessed in a certain city is $44,382. The taxable property is $2,850,800. The number of polls, each assessed $1.50, is 1080. What is the rate of taxation?

9. A factory worth $33,000 is insured for $\frac{3}{4}$ of its value at 2%. In case of total loss, how much would the owner lose, including the premium paid?

10. A dealer sold goods at $1.84 a yard, and gained 5%. At what should he have sold a yard to gain $18\frac{3}{4}$%?

XVII

1. Add 149 sq. rd., 28 sq. yd., 7 sq. ft.; 59 sq. rd., 19 sq. yd., 8 sq. ft.; 115 sq. rd., 23 sq. yd., 6 sq. ft.

2. Find the simple interest at $3\frac{1}{2}$% of $956.75 from June 21, 1909, to March 8, 1911.

3. A grocer bought a chest of tea containing 240 lb. for $182.40 and sold it at 85 ct. a pound. Find his gain per cent.

4. Find the cost at $47.50 per M of 17 planks 15′ long, 16″ wide, and $2\frac{1}{2}$″ thick.

5. Find the net amount of a bill for $1240 subject to successive discounts of 10%, 14%, and $12\frac{1}{2}$%.

6. Find the cost, at 49 ct. a square yard, of plastering the walls and ceiling of a room 17′ × 15′ and $10\frac{1}{2}$′ high.

7. The proceeds of a 60-da. note discounted at 6% 28 da. after date are $566.96. Find the face of the note.

8. What per cent does 6 % stock yield if bought at $114\frac{7}{8}$, brokerage $\frac{1}{8}$ %?

9. At the end of 4 years a man has paid $150 for insuring a house for $5000. Find the annual rate of insurance.

10. Simplify $\dfrac{4-1\frac{4}{5}+\frac{12}{25}}{\frac{1}{4}-\frac{1}{6}\times\frac{3}{4}}$.

XVIII

1. Add:
39845
93624
83965
91387
99285
36492
81926
99389
84793
98495
97937
95964
88937
85936
97382
89249

2. Find the cost of the following pieces of hemlock lumber at $36 per thousand: —

3 scantlings	2 inches by	4 inches by	12 feet
4 planks	2 inches by	12 inches by	12 feet
5 sills	12 inches by	12 inches by	12 feet

3. New York is 74° 0′ 3″ west longitude and Chicago is 87° 37′ 30″ west. When it is noon in New York, what is the time in Chicago?

4. Solve the following: —

(*a*) $31\frac{1}{2}-18\frac{7}{8}=?$
(*c*) $18\frac{4}{7}\times 23\frac{7}{8}=?$
(*b*) $2\frac{1}{16}+5\frac{4}{9}+\frac{2}{3}+6\frac{3}{8}=?$
(*d*) $4\frac{9}{10}\div 12\frac{5}{6}=?$

5. Find the simple interest of $921 from Sept. 1, 1908, to Jan. 27, 1910, at 5 %.

6. How many hectoliters of water will a cistern hold that is 6 m. long, 4 m. 5 dm. wide, and 3 m. deep?

7. Find the cost of a bill of goods amounting to $3500 from which the following successive trade discounts were allowed: 37 %, 4 %.

8. A dealer pays $30 for a case of shoes containing six pairs. If he sells the shoes for $6.50 per pair, what per cent does he make?

9. Find the square root of 1,199,025.

10. A cubic block of wood measures 4 ft. each way. Find (*a*) its entire surface; (*b*) its weight, on the basis of 32 lb. to the cubic foot.

XIX

1. If a man can travel 33.68 mi. in 0.8 of a day, how far can he travel in 7.5 da.?

2. Express as a rate per cent: $\frac{1}{6}$, $\frac{3}{8}$, $\frac{3}{5}$, $\frac{2}{3}$, $\frac{11}{50}$.

3. Reduce to a common fraction: $8\frac{1}{3}$ %, $37\frac{1}{2}$ %, $56\frac{1}{4}$ %, $33\frac{1}{3}$ %, 125 %.

4. A commission merchant sold 184 bbl. of apples at $2.75 per barrel and received 5 % commission. What was the amount of his commission?

5. (*a*) If $\frac{3}{4}$ of a yard of cloth costs $\$3\frac{3}{4}$, what will 5 yards cost?

(*b*) If $1\frac{3}{4}$ tons of hay cost $31.50, what will $5\frac{1}{4}$ tons cost? (Use a short method.)

6. Add fifteen thousandths, eighty-one ten-thousandths, fifty millionths, seventeen ten-millionths, and two hundred-thousandths.

7. Reduce to simple fraction: $\dfrac{\frac{5}{8} \text{ of } 3\frac{2}{3}}{\frac{5}{6} \text{ of } 2\frac{4}{5}} \div 6\frac{2}{3}$.

8. Find the interest of $960 for 2 yr., 5 mo., 21 da. at 8 %.

9. A note of $1115, dated July 6, 1883, was indorsed as follows: Sept. 15, 1883, $180; Jan. 2, 1884, $225; March 20, 1884, $300. What was due May 1, 1884, the rate of interest being 6 %?

10. A man bought 26 yd. carpet at $\$1\frac{9}{10}$ a yard, 3 curtains at $\$5\frac{3}{5}$ each, and 6 chairs at $\$1\frac{3}{4}$ each. What was his bill?

XX

1. A man owning $\frac{1}{4}$ of a vessel sold $\frac{3}{4}$ of what he owned for \$1200. What was the value of the vessel at that rate?

2. What is the price of hay per ton when $5\frac{5}{9}$ tons are worth \$75?

3. Change $\frac{3}{125}$ to a decimal. Reduce $0.87\frac{1}{2}$ to a common fraction.

4. Write decimally seventy-five and five thousand forty-three millionths.

5. If a man pays \$$6\frac{3}{4}$ for a barrel of flour, how many barrels can be bought for \$$74\frac{1}{4}$?

6. A farmer sold $320\frac{3}{4}$ lb. maple sugar at $15\frac{3}{4}$ ct. a pound and took his pay in cloth at $67\frac{1}{2}$ ct. a yard. How many yards did he receive?

7. A flour merchant bought 130 bbl. flour at \$$6\frac{2}{3}$ per barrel. He sold 85 bbl. at \$$6\frac{9}{10}$ per barrel and the remainder at \$7. What did he gain?

8. Find the sum of 5.00695, 193.5, 47.25, 5.875, 9.0000105 and write the answer in words.

9. (*a*) Find $66\frac{2}{3}$% of $\frac{7}{15}$. (*b*) Find $\frac{1}{2}$% of \$540.

10. Express each as a rate per cent: $38\frac{7}{25}$, $\frac{13}{20}$, $\frac{3}{5}$, $\frac{1}{6}$.

XXI

1. A tax of \$11,000 is to be levied on city property assessed at \$500,000. If there are 500 polls each paying \$2, what will be the tax of a man whose property is assessed at \$12,500?

2. A car containing 8400 bu. of wheat worth \$0.90 a bushel is insured for $\frac{3}{4}$ its value at $1\frac{3}{8}$% premium. If the wheat is destroyed, how much will the owner lose, including premium?

3. Find the interest of $500 for 1 yr., 2 mo., 18 da. at 7½%.

4. At 5% interest, how much will $375 amount to from July 30, 1906, to June 2, 1910?

5. If a tax of $120 is assessed on a mill valued at $24,000, what is the value of a store that is taxed $177.50 at the same rate?

6. An agent received $28 as his commission at 3½% for buying prints at 7½ ct. a yard. How many yards did he buy?

7. If 15% is lost by selling suits at $17 each, for how much must they be sold to gain 15%?

8. A farmer after selling 1760 bbl. of apples had 20% of his crop left. How many barrels did he raise?

9. Which will be cheaper and how much — to buy goods listed at $200 discounted at 25% and 15%, or the same goods discounted at 20% and 20%?

10. What will be the cost of digging a cellar 36 ft. square and 7 ft. deep at $0.66⅔ a cubic yard?

XXII

1. Find the interest on $800 from Sept. 10, 1909, to the present time at 4½%.

2. I bought 500 bbl. of flour at $4.75 a barrel and marked it to sell at $5.50 a barrel. It having been damaged by smoke, I deduct 20% from my marked selling price. Do I gain or lose and how much on the lot?

3. I lend a man $250 at 6% simple interest. He pays me in full at the end of 3 yr. and 15 da. How much do I get?

4. At 8% simple interest, how long would it take $100 to earn $22 interest?

5. At 6 % simple interest, what principal is required to earn $76 interest in 3 yr. and 2 mo.?

6. Two houses are sold for $3000 each. On one the owner gained 5 %, on the other he lost 5 %. Did he gain or lose on both and how much?

7. One year a man raised 300 bu. of apples, the next 450 bu. What was the per cent of gain of the second year over that of the first?

8. Add 42⅚, 100½, 9⅗, 7⁄12, 125, 17.6, and 27.2½. Multiply the result by 6.

9. A tax of $1500 is to be raised on property valued at $250,000. What tax must a man who has property valued at $8000 pay?

10. A barn valued at $3900 was insured for ⅔ its value at ½ %. If destroyed, how much does the owner actually lose?

XXIII

1. How long must a pile of wood 4 ft. wide and 7 ft. high be to contain 7 cd.?

2. How many board feet in 3 sticks of timber 12 ft. long and 6 in. square?

3. How many inches in ⅓ of a yard? In 33⅓ % of a yard? What is the difference in the value of the following expressions: ¾, 0.75, 75 %? Give reason for your last answer.

4. A man sold his cow so as to gain $10, which was 25 % of the cost. What was the cost? Why is it incorrect to say 25 % = $10? What would be the correct thing to say?

5. A man bought a horse for $250 and sold it at a gain of 20 %. What did he receive?

6. In Example 5 if the man had sold his horse at a loss of ⅕ the cost, what would he have received?

7. A farmer raised 1000 bu. of potatoes and sold $\frac{2}{5}$ of them at one time, 15 % at another, and 0.24 at another. How many bushels were left?

8. Mr. Jones sold his house for $6250, which was a gain of 25 %. How many dollars did he gain?

9. Which is more advantageous for the buyer and how much — to buy $500 worth of goods with 25 % and 15 % off, or a single discount of 40 %?

10. A merchant sold for $350 a piano that cost him $250. What was his gain per cent?

XXIV

1. Given a quotient of 7508, a divisor of 7406, and a remainder of 3207; find the dividend.

2. A city block in the form of a rectangle is 237 feet wide and 509 feet long. How many acres does it contain?

3. The cross section of a subway is $15' \times 16'$. Its length is $1\frac{1}{2}$ mi. How many barge loads of 1600 cu. yd. each will there be of the material excavated in digging this subway?

4. A steamer so changed its position during 24 hr. as to necessitate setting the ship's clock ahead about 42 min. In what direction was the steamer going, and what change had been made in its longitude?

5. A man's investment in business is $7200. His income for one year is $1200. What per cent of the income is the investment?

6. A man sold a cow for $48 and thereby gained 20 per cent of the purchase price. What was his gain?

7. In what time will $980 amount to $1200 at 5 % simple interest?

8. A man whose property is assessed $3264 pays a school tax of $16.32. The total tax raised is $4800. What is the assessed valuation of the district?

9. The area of a square is 841 sq. in. Find the area of another square whose side is the longest straight line that can be drawn in the first square.

10. A man purchased 600 shares of stock paying annual dividends of 8% for $227.50 per share, brokerage $\frac{1}{8}$%. What is the rate of interest on the investment?

XXV

1. Add:
4368
5962
6857
7976
8795
9874
2345
9876
1234
5678
9123
7654
8912
6789
5432
8973
9876
5432

2. A man travels 360 mi. in 12 da. At the same rate, how far will he travel in 21 da.?

3. Find the simple interest of $3562 from Jan. 28, '08, to June 18, '10, at $4\frac{1}{2}$%.

4. Taking the two numbers 445.3 and 0.073, find (*a*) their sum, (*b*) their difference, (*c*) their product, (*d*) the quotient of the first divided by the second.

5. A corner lot has 96 ft. front and is 180 ft. deep. Find the cost of laying a 4-ft. stone walk on the front and side at 18 ct. per square foot. (Draw a diagram of the lot and walk.)

6. A boy bought oranges at 20 ct. per dozen and sold them at the rate of 2 for 5 ct. What per cent did he gain?

7. Which is the better for the purchaser and how much — two successive trade discounts of 25% and 10% on a bill of $500, or a single discount of $33\frac{1}{3}$%?

8. The total assessed valuation of a certain school district was $2,559,000. The amount to be raised by tax was $11,515.50. Find the amount of tax on a block assessed at $85,000.

9. A horse tied to a stake can reach the grass 30 ft. in any direction from the stake. Over how many square feet of land can the horse graze?

10. If the distance between two places is 320 km., how many miles is it? (A meter is approximately 39.37 inches.)

XXVI

1. A liter of air weighs 1.273 g. What is the weight in kilograms of the air in a room 7 m. long, 5 m. wide, and 4 m. high?

2. Find the simple interest of $685.70 at $5\frac{1}{2}\%$ for 1 yr., 7 mo., 20 da.

3. Find the value of (*a*) $\dfrac{1\frac{4}{5} \times 3\frac{3}{4} \div 6\frac{3}{4}}{\frac{2}{3} \div \frac{7}{12} - \frac{4}{7}}$.

(*b*) $(3.005 \times 0.006) \div 0.0009$.

4. The longitude of St. Paul is 93° 5′ west and that of St. Petersburg is 30° 18′ east. What is their difference in longitude? In time?

5. Factor 924, 168, and 396; from these factors determine (*a*) the greatest common divisor, (*b*) the least common multiple.

6. Find the square root of 119,716.

7. A pipe fills a tank at the rate of 1 gal., 1 pt., 2 gi. a second. If the capacity of the tank is 4899 gal., 2 qt., 1 pt., how much time will be required to fill it?

8. What was the list price of an article whose net cost was $6.15 after discounts of 20 % and 25 % were deducted?

9. A man lost $\frac{4}{7}$ of his entire crop of apples and sold the remainder for $300. How many bushels did he have at first if apples were worth 20 ct. a peck?

10. Find the cost of fencing a rectangular field 22 rd. × 36 rd. with a four-wire fence, if the fence posts are 11 ft. apart and cost 9 ct. each and the wire costs $\frac{1}{2}$ a cent a foot.

XXVII

1. Add:
68530
26982
16450
19247
36293
18964
73251
57368
47527
10339
82644
63102
38972
85654
23456

2. If the capital of a certain stock company is $60,000 and profits amounting to $6300 are to be distributed among the stockholders, how much profit will there be for each $100 of the stock?

3. A note for $420, dated April 30, 1909, with interest at 5%, is paid in full to-day, Jan. 26, 1910. Find the amount required to pay both principal and interest.

4. (*a*) Multiply 398.69 by 87.96.
(*b*) Divide 63,843.84 by 9.78.

5. A broker borrows $7500 in Boston at 4% and purchases a $7\frac{1}{2}$% Western mortgage. How much will he gain in 5 yr.?

6. A flagstaff 40 ft. high casts a shadow 30 ft. in length. What is the distance from the end of the shadow to the top of the pole?

7. What will be the cost of carpeting the floor of a room 22 ft. by 18 ft. with carpet $\frac{3}{4}$ yd. wide at 85 ct. a yard?

8. A man insures a house, valued at $3500, for $\frac{4}{5}$ of its value at $\frac{3}{4}$%. What did the insurance cost him? What is his whole loss if the house burns?

9. If a bin is 3 m. long, 11.5 dm. wide, and 2 m. deep, how many hectoliters of grain will it contain?

10. Make a receipted bill of the following items bought of Frank Jones by William French: 26 lb. of sugar at 5½ ct. a pound; 24 lb. of lard at 6½ ct. a pound; 5 bu. of potatoes at 78 ct. a bushel; 3 gal. of molasses at 65 ct. a gallon; 4 lb. of rice at 10 ct. a pound; 8 lb. of coffee at 35 ct. a pound; 3 heads of cabbage at 8 ct. a head; 2 bu., 3 pk. of apples at 80 ct. a bushel.

XXVIII

1. I sold a farm for $5000 and thereby made 25%. Should I have gained or lost, and how much per cent, if I had sold it for $3500?

2. My agent in New Orleans has sold for me 400 pairs of boots at $1.50, 900 pairs of shoes at $0.75. What is his commission at 3%, and what shall he remit to me?

3.

MR. RICHARD HENRY,
To WILLIAM HART & SON, Dr.
To 55 lb. of pipe at 5½ ct.
To 3 faucets at 87½ ct.
To 1 sink $4.75
To 3½ days' labor at $4.50

Copy and complete the above bill and receipt it.
Who is the debtor in the above account?
Who is the creditor?
Write a check on some bank paying the above bill.

4. Write a receipt for rent of house, 37 Roosevelt Ave., occupied by Michael Smith, paying $27 per month, for the month of April and 16 da. in May. The house is owned by James Otis. Make out the receipt.

5. Henry Stone gave his note to Charles Winter Jan. 1, 1909, for $387.50, with interest at 7 % from date. What should Mr. Stone pay to discharge this note Oct. 20, 1909?

What kind of a note was given?

What is Henry Stone called?

What is Charles Winter called?

What is $387.50?

6. How long must $1200 be on interest at 5 % to amount to $1273.50?

7. A square lawn contains 11,664 sq. yd. What will it cost to fence it at $1.25 a yard?

8. A ladder 55 ft. long may be so placed in a street as to touch a window 44 ft. high on one side, and on being turned over without changing its base, it will reach another window 33 ft. high on the opposite side of the street. Find the width of the street.

9. A real estate agent sold 2 farms for $6000 each; on one he made 25 % and on the other he lost 25 %. Did he gain or lose on the whole, and how much?

10. What is the diameter of a circular pond which shall contain 25 times as much area as one 8 rd. in diameter?

XXIX

1. I bought a cask of molasses containing 84 gal. for $28. 9 gal. having leaked out, at what price per gallon must I sell the remainder to gain $4.25?

2. How many cords in a pile of wood 24 ft. long, 16 ft. wide, and 12 ft. high? What will it cost at 4½ ct. per cu. ft.?

3. Two ships sail from the same port, one due north and the other due west; one at the rate of 6 mi. and the other 8 mi. per hour. How far apart are the ships in 10 hr.?

4. What is the area of a triangle whose base is 49 ft. and whose altitude is 377 ft.?

5. What is the diagonal of the floor of a room 40 ft. long and 30 ft. wide?

6. What must I pay for laying a sidewalk 6 rd. long and 5 ft. wide at $0.45 a square yard?

7. How much will a block of granite weigh 15 ft. long, 12 ft. wide, and 9 ft. thick, if a cubic foot weighs 72 lb.?

8. How much will it cost to plaster a room 18 ft. long, 15 ft. wide, and 9 ft. high at 17 ct. a square yard, deducting 108 sq. ft. for doors and windows?

9. The model schoolroom is 32 ft. long, 25 ft. wide, and 14 ft. high. How many cubic inches of air does it contain?

10. How many acres are there in a four-sided field having two parallel sides which are 60 rd. apart, and 40.05 rd. and 60.08 rd. long, respectively?

XXX

1. In a certain school $\frac{1}{4}$ of the pupils belong to the first grade, $\frac{5}{24}$ to the second grade, $\frac{3}{8}$ to the third grade, and the remainder, which is 192, to the fourth grade. How many pupils are there in the whole school?

2. A room is 30 ft. long, 24 ft. wide, and 15 ft. high. Find the entire surface of the room.

3. At $1.50 per yard, what will it cost to carpet the room described in the preceding problem, the carpet being 1 yd. wide?

4. Make out and receipt a bill for the following: 28 gal. oil at 12 ct. per gallon, 5 lb. paint at 68 ct. a pound, 15 panes glass at 18 ct. each.

5. (*a*) One month I burned 8400 cu. ft. of gas. What was the amount of my bill, gas being $1.05 per thousand?

(*b*) What would the net amount be if I received a discount of 2 ct. per hundred for paying on or before the fifteenth of the month?

6. Find the interest of $675 from March 6, 1903, to June 18, 1907, at 4½ %.

7. I bought two horses for $125 each. I sold one at a gain of 40 % and the other at a loss of 4 %. What was received for both?

8. Solve by proportion: If 15 bu. of wheat can be bought for $10.20, how much can be bought for $136?

9. Two ships sailed from the same harbor, one 150 mi. east and the other 200 mi. south. How far apart were they then?

10. A horse is tethered to a post by a rope 21 ft. long. What is the area of the circle over which he may graze? What is the diameter of the circle? Its radius? Its circumference?

XXXI

1. Jan. 12, 1909, Mr. Ames borrowed $600 at 5 %. What must he pay to cancel the debt to-day?

2. (*a*) What distance will a man walk in 4½ hr. if he walks at the rate of 3⅔ mi. an hour?

(*b*) If a family use 19⅘ lb. of butter in 7⅓ da., how many pounds are used each day?

3. By selling a house for $3500 I lose $500. What is my loss per cent?

4. My house, worth $12,000, is insured for ¾ of its value at ¼ %. What premium do I pay?

5. What will it cost to plaster a room 18′ × 12′ × 9′ at 40 ct. per square yard?

6. If a map 10 in. wide and 16 in. long is made on a scale of 50 mi. to the inch, what is the area in square miles that the map represents?

7. A woman bought remnants of silk as follows: $5\frac{3}{8}$ yd., $4\frac{3}{4}$ yd., $6\frac{1}{8}$ yd., and $5\frac{7}{8}$ yd. What did it cost her at \$$2\frac{2}{3}$ a yard?

8. Find the cost of a lot of land 30 rd. by 24 rd. at \$120 an acre.

9. What will it cost to fence a square field of 10 A. at \$1.25 a rod?

10. If a piece of cloth shrinks 2 yd. and the shrinkage is 5 %, what was the original length?

XXXII

1. Find the dimensions, in rods, of a 90-A. rectangular field whose length is 4 times its width.

2. A ball field is 110 yd. long and 160 ft. wide. Find the side of a square of the same area.

3. A square field contains 40 A. Find the cost of fencing it at \$2.75 per rod of fence.

4. What will it cost to plaster a room 40 ft. long, 36 ft. wide, and 10 ft. high at 18 ct. a square yard, deducting 90 sq. ft. for doors and windows?

5. Find the cost of a pile of wood 32 ft. long, 24 ft. wide, and 16 ft. high at \$6.25 a cord.

6. The area of a triangle is $2131\frac{1}{2}$ sq. rd. The altitude is 87 rd. What is the base?

7. A ladder 97 ft. long is placed 65 ft. from the foot of a building. How high on the building will it reach?

8. A grain box is 8 ft. by 6 ft. by 11 ft. Allowing $1\frac{1}{4}$ cu. ft. to the bushel, how many bushels will the box contain?

9. Find the simple interest of \$945.96 for 2 yr., 3 mo., 6 da. at $4\frac{1}{2}\%$.

10. The perimeter of a rectangle is 352 ft., and its length is 120 ft. Find its width, diagonal, and area.

XXXIII

1. I sold 10 shares of stock at $106\frac{1}{2}$. I bought it for 105. What was my gain? (Brokerage $\frac{1}{8}\%$ in each transaction.)

2. A mining stock pays 12% annually. My dividend is \$240. How many \$100 shares of the stock do I own?

3. If I receive \$207 a year upon \$4600 invested, what per cent do I receive?

4. Divide the number 45 into two parts which shall be to each other as 7 to 2.

5. Divide \$8.16 among 4 boys in the proportion of 3, 5, 7, and 9. How much will each receive?

6. What is the ratio of 18 to 54? Of 2 ft. to 4 in.?

7. Find the missing terms: (*a*) $10 : 6 = 6 : ?$
(*b*) $? : \frac{3}{8} = \frac{1}{9} : \frac{1}{3}$.

8. Mr. Jones receives an income of \$600 from 5% bonds. What is the face value of the bonds?

9. I buy a bill of goods listed at \$600. The discounts are 25% and 10%. What is the net price?

10. Compare $\frac{2}{5}$ of something with $\frac{2}{5}\%$ of it.

XXXIV

1. Find the cost of plastering a rectangular surface 18 ft. long and 15 ft. wide at \$2.75 per square yard.

2. A horse is so fastened with a rope halter that he can feed over a circle 25 ft. in diameter. Find the area of the surface over which the horse can feed.

3. How long a ladder is required to reach a window 20 ft. high, if the foot of the ladder is 15 ft. from the building?

4. How much lumber in 25, 16-ft., 2-in. boards, each of which is 12 in. wide?

5. How many square feet are there in the whole surface of a cubical block of granite which contains 729 cu. ft.?

6. The parallel sides of a trapezoid are respectively 16 ft. and 18 ft., and the distance between the parallel sides is 10 ft. What is the area of the trapezoid?

7. The radius of a circle is 7 in. What is its circumference?

8. How many feet of fencing will be required to inclose a field which contains 8100 sq. ft. in the form of a perfect square?

9. (*a*) What is the cube of 1? Of 3? Of 5?
   (*b*) What is the 4th power of 1? Of 2?

10. Find the base of a right triangle, the hypothenuse of which is 25 in. and altitude 15 in.

XXXV

1. Water freezing into ice expands 10%. What volume of water will be required to make a cake of ice 1½ ft. × 1½ ft. × 1⅓ ft.?

2. A house is 32 ft. × 30 ft. × 22 ft., without gables. At 21 ct. per square yard, find cost of painting the outside of it.

3. What is the speed ratio of a train which runs 65 mi. an hour to one which runs 30 mi. in 40 min.?

4. How many yards of carpeting ¾ yd. wide are required to cover a floor 27 ft. long and 17½ ft. wide?

5. How many times can 85 be subtracted from a hundred thousand, and what will be the final remainder?

6. A man paid $7650 for stock at 10% below par, and sold the stock at 10% above par. What was his gain? (No brokerage.)

7. When one pays $4.90 for 8 bu., 3 pk. potatoes, what is the price per bushel?

8. A man who owned thirty-four hundredths of a vessel sold thirty-four thousandths of his share. How much of the vessel did he then own?

9. How much is due a man who is to receive to-day (June 18, 1910) payment in full of a loan of $897 which was made Jan. 25, 1909, at 5% interest?

10. What is the value on July 1, 1909, of a bill of $1000 due Jan. 1, 1910, assuming that interest or discount rates are 5%?

APPENDIX

RULES FOR REFERENCE

1. — A **rule** in arithmetic gives directions for performing the operations necessary to obtain a desired result.

A clear understanding of subjects and principles will make rules unnecessary. The following, which refer to the more difficult processes, are given for reference. Quantities described concretely must often be considered as abstract.

2. — FACTORING

Greatest Common Divisor. I. (1) *From the given numbers reject all multiples of any of the given numbers.* (2) *Separate each of the remaining numbers into its prime factors.* (3) *Find the product of all the common prime factors. This will be the G.C.D. required.* Or, —

II. *Divide the greater number by the less and the preceding divisor by the last remainder till nothing remains. The last divisor is the G.C.D. If there are more than two numbers, find the G.C.D. of any two of them, and then of this G.C.D. and a third number, and so on.*

Least Common Multiple. I. (1) *Reject from the given numbers all that are divisors of any of the rest.* (2) *Separate each of the remaining numbers into its prime factors.* (3) *Multiply the largest of the given numbers by all the prime factors of the other numbers that are not found among its own. This product will be the L.C.M. required.* Or, —

II. (1) *Strike out any of the given numbers that are factors of any of the others, and divide the remaining numbers by any prime factor common to two or more of them.* (2) *Strike out from the resulting quotients and undivided numbers all that are factors of any of the rest, and divide as before.* (3) *Thus proceed until no two of the remaining numbers have a common factor. The product of the divisors and remaining numbers will be the L.C.M. required.*

3. — FRACTIONS

To Lowest Terms. *Divide both terms of the fraction by their G.C.D.*

To a Required Denominator. (1) *Divide the required denominator by the given denominator.* (2) *Multiply each term of the given fraction by the quotient.*

To Mixed Numbers. *Divide the numerator by the denominator.*

Mixed Numbers to Improper Fractions. *Multiply the integer by the denominator, and to the product add the numerator. Write the sum over the denominator.*

To a Common Denominator. (1) *Find the L.C.M. of the denominators of the given fractions.* (2) *Divide this by the denominator of each fraction and multiply both terms by the quotient.*

Addition. (1) *Change the fractions to like fractions with a common denominator.* (2) *Find the sum of the numerators.* (3) *Simplify the result.*
Add integers and fractions separately in adding mixed numbers.

Subtraction. *Proceed as in addition of fractions, excepting that the difference of the numerators is to be taken instead of their sum.*

Multiplication. I. When one factor is an integer. *Either* (a) *multiply the numerator by the integer, or* (b) *divide the denominator by it.*

II. When one factor is an integer and the other a mixed number. (1) *Multiply the integer first by the fractional part, then by the integral part of the multiplier.* (2) *Add the partial products.*

III. When the factors are mixed numbers or fractions. (1) *Change integers and mixed numbers to improper fractions.* (2) *Write the product of the numerators over that of the denominators.* (3) *Simplify the result. (The process may often be shortened by cancellation.)*

Division. I. A fraction by an integer. *Either* (a) *divide the numerator or* (b) *multiply the denominator by the integer.*

In general. II. (1) *Change dividend and divisor to fractional form, and then* (2) *to a common denominator.* (3) *Write the quotient of the numerators over the common denominator;* or, III. *Multiply the dividend by the divisor inverted.*

4. — DECIMALS

To Common Fractions. *Express the denominator and change the fraction to smallest terms.*

Common Fractions to Decimals. *Annex decimal ciphers to the numerator and divide by the denominator.*

Addition and Subtraction. *As with integers.*

Multiplication. (1) *As with integers.* (2) *Give the product as many decimal places as there are in all its factors.*

Division. (1) *Make the divisor an integer by removing the decimal point.* (2) *Move the decimal point in the dividend an equal number of places in the same direction.* (3) *Divide as with integers.* (4) *Give the quotient as many decimal places as have been used in the dividend.*

MEASUREMENTS

Note. — In the following rules dimensions are spoken of as abstract numbers.

5. — Of Lines

To find —

The Perimeter of a Polygon. *Take the sum of its bounding lines.*

One Dimension of a Parallelogram. *Divide its area by the given dimension.*

One Dimension of a Rectangular Prism. *Divide its volume by the product of the two given dimensions.*

The Side of a Square. *Take the square root of its area.*

The Diagonal of a Square. *Take the square root of twice its area.*

The Diagonal of a Rectangular Prism. *Take the square root of the sum of the squares of its three dimensions.*

The Circumference of a Circle or Sphere. *Multiply the diameter by* 3.1416.

The Diameter of a Circle or Sphere. *Multiply the circumference by* 0.31831, *or divide by* 3.1416.

An Hypotenuse of a Right Triangle. *Take the square root of the sum of the squares of the short sides of the triangle.*

One of the Short Sides of a Right Triangle. *Take the square root of the difference of the squares of the given sides.*

6. — Of Surfaces

Note. — Before multiplying, dimensions must be changed to like numbers.

To find the Area of —

A Parallelogram. *Find the product of base and altitude.*

A Triangle. *Find half the product of base and altitude.*

A Trapezoid. *Multiply the altitude by half the sum of its parallel sides.*

Other Polygons. *Divide into triangles and find the sum of their areas.*

A Sector. *Find half the product of arc and radius.*

A Circle. *Multiply the square of the diameter by* 0.7854.

The Lateral Surface of a Prism or Cylinder. *Multiply the perimeter of the base by the altitude.*

The Lateral Surface of a Pyramid or Cone. *Multiply the perimeter of the base by half the slant height.*

A Sphere. *Multiply circumference by diameter;* or, *multiply the square of the diameter by* 3.1416.

7.—OF SOLIDS

To find the Volume of a—

Rectangular Solid. *Find the product of its three dimensions.*

Prism or Cylinder. *Multiply the area of the base by the altitude.*

Pyramid or Cone. *Multiply the area of the base by one-third the altitude.*

Sphere. *Multiply the cube of the diameter by* 0.5236.

A Frustum of a Pyramid or Cone is what remains *after* cutting off the top in a plane parallel to the base. To find its volume: (1) *Find the area of each of the two bases.* (2) *Add to their sum the square root of their product.* (3) *Multiply this result by one-third the altitude.*

To find —

The Number of Board Feet in a Piece of Lumber. *Multiply the product of its length and width in feet by its thickness in inches. (Disregard thickness when it is one inch or less.)*

8.—PERCENTAGE

To find the—

Percentage. *Multiply the base by the rate per cent.*

Base. *Divide the percentage by the rate per cent.*

Rate per cent. *Divide the percentage by the base.*

What constitutes base, percentage, rate %, etc., in business operations, is shown in the following table:—

	BASE.	PERCENTAGE.	RATE PER CENT.	AMOUNT.	DIFFERENCE.
Profit and Loss.	Cost.	Gain or Loss.	Rate of Gain or Loss.	Cost plus Gain; or Selling Price.	Cost less Loss; or Selling Price.
Insurance.	Sum insured.	Premium.	Rate of Insurance.	—	—
Commission.	Amount of Purchase or Proceeds of Sale.	The Agent's Commission.	Rate of Commission.	Investment plus Commission or Remittance.	Proceeds of Sale less Commission.
Trade Discount.	Face of Bill or List Price.	The Discount.	Rate of Discount.	—	Base less the Discount.
Taxes.	Valuation of all Property.	Total tax less poll-tax.	Shown by tax on $1.	—	—
Duties.	Cost as per Invoice.	Ad Valorem Duty.	Rate of Tariff.	Cost of Importation.	—

9.—INTEREST

General Method. *Find the product of the principal, rate per cent, and time in years.* (*The time may be taken in months or in days, provided the product is divided by* 12 *or* 360, *as the case may be.*) *Use cancellation.*

Principal and interest added will give the amount.

One Dollar Method. To find the interest of one dollar at 6%: *Reckon* 6 *cents for each year,* 5 *mills for each month, and* $\frac{1}{6}$ *of a mill for each day.*

To find the interest of any sum: *Multiply one dollar's interest by the principal.*

For any rate except 6: *Add to or subtract from the interest at* 6% *a proportional part of itself.*

Bankers' Method. To find interest at 6%: *Find* 20 *months' interest by taking* $\frac{1}{10}$ *of the principal, or* 60 *days' interest by taking* $\frac{1}{100}$ *of it. Then take such parts or multiples of these as the given time may require.*

Exact Interest. For any part of a year: *Find the common interest for the exact number of days in the given part of a year; then lessen it by $\frac{1}{73}$ of itself.*

To find the Principal. *Divide the interest by the product of the rate and the time in years.*

To find the Rate. *Divide the interest by the product of the principal and the time in years.*

To find the Time. *Divide the interest by the product of the principal and the rate per cent. The quotient is the time in years.*

To find the Amount due on a Note on which Partial Payments have been made. United States rule: *Find the amount of the principal to the time when a payment or the sum of several payments shall equal or exceed the interest due at the time. Subtract such payment or sum of payments from the amount, and with the remainder as a new principal, proceed as before to the time of settlement.*

Compound Interest. *Find the amount of the principal for the first period of time. Treat this amount as a new principal, and find its amount for the second period, and so on for the entire time. The last amount less the given principal will be the compound interest.*

Present Worth. *Divide the given debt by the amount of* $1 *for the time to elapse before the debt is due. The debt less the present worth is the true discount.*

10. — DISCOUNT

Bank Discount. *Compute bank discount as if it were simple interest on the face of the note for the term of discount. The face of the note less the bank discount will be the proceeds.*

True Discount. *See Present Worth*, § 9.

11. — PROPORTION

Rule of Three. *Make that number in the problem which is of the same kind as the desired result the third term of a proportion.*

If, from the conditions of the question, the result is to be larger than the third term, use the two like numbers in making the first ratio of the proportion less than 1; *but if the result is to be smaller, make the first ratio greater than* 1.

Divide the product of the means by the given extreme, and the quotient will be the fourth term of the proportion, or the result desired.

Partnership. *Give each partner such part of the whole gain or loss as his capital for any time is part of the whole capital for the same time.*

12. — ROOTS

Extracting the Square Root.

I. *Beginning at the decimal point, separate the given number into groups of two figures each.*

II. *Find the greatest square in the left group and place its root at the right; subtract the square of this root from the left group, and to the remainder annex the next group for a dividend.*

III. *Divide this dividend, omitting the last figure, by double the root already found, and annex the quotient to the root, and also to the divisor.*

IV. *Multiply the divisor as it now stands by the last root figure and subtract the product from the dividend.*

V. *If there are more groups to be brought down, proceed in the same manner as before.*

Extracting the Cube Root.

I. *Beginning at the decimal point, separate the given power into groups of three figures each.*

II. *Find the greatest cube in the left group and place its root at the right. Subtract the cube of this root from the left group, and to the remainder annex the next group for a dividend.*

III. *Annex a cipher to the root already found and take three times its square for a trial divisor. Divide the dividend by this trial divisor and place the quotient as the next root figure.*

IV. *Multiply the number last squared by the last root figure and add three times this product and the square of the last root figure to the trial divisor for a complete divisor.*

V. *Multiply the complete divisor by the last root figure, subtract the product from the dividend, and to the remainder annex a new group.*

VI. *Form a second trial divisor, using two figures of the root with a cipher annexed, and proceed as before until all the groups have been used.*

TABLES OF MEASURES

[FOR REFERENCE]

Counting.

12 things = 1 dozen (doz.)
12 dozen = 1 gross (gro.)
12 gross = 1 great gross (g. gr.)
20 things = 1 score

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24 sheets (paper) = 1 quire
20 quires or 480 sheets = 1 ream

Time.

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (h.)
24 hours = 1 day (d.)
7 days = 1 week (wk.)
2 weeks = 1 fortnight
30 (31, 28, 29) days = 1 month (mo.)
3 months or 13 weeks = 1 quarter
12 months 365 days = 1 year (yr.) (common)
365 d. 5 h. 48 min. 49.7 sec. = 1 true or solar year
366 days = 1 leap year
10 years = 1 decade
100 years = 1 century (C.)

Value.

U. S. Money.

10 mills (mi.) = 1 ct. (ct., c., or ¢)
10 cents = 1 dime (di.)
100 cents or 10 dimes = 1 dollar ($)
10 dollars = 1 eagle

Canadian Money.

100 cents = 1 dollar = $1

English Money.

12 pence (*d.*) = 1 shilling (*s.*) = $0.243+
20 shillings = 1 pound (£) = $4.8665

French Money.

100 centimes = 1 franc (fr.) = $0.193

German Money.

100 pfennigs = 1 mark (M.) = $0.238

Capacity.

Liquid Measures.

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

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1 gallon = 231 cu. in.

Dry Measures.

(For grain, fruit, etc.)

2 pints = 1 quart.
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)
10 pecks 2½ bushels = 1 barrel (bbl.)

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1 bushel = 2150.42 cu. in.

Weight.

Avoirdupois Weight.

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
2000 pounds or 20 hundredweight = 1 ton (T.) (short)
2240 pounds = 1 long ton

*60 pounds = 1 bushel wheat or potatoes
*56 " = 1 " corn or rye
*32 " = 1 " oats
196 " = 1 barrel flour
200 " = 1 " beef or pork

* In most States.

Troy Weight.

(For precious metals, jewels, etc.)

24 grains = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce
12 ounces = 1 pound

437½ grains = 1 ounce
7000 " = 1 pound } Av.
480 " = 1 ounce
5760 " = 1 pound } Troy.

Apothecaries' Weight.

20 grains = 1 scruple (sc. or ℈)
3 scruples = 1 dram (dr. or ʒ)
8 drams = 1 ounce (oz. or ℥)
12 ounces
5760 grains } = 1 pound (lb. or ℔.)

Length.

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
16½ feet or
5½ yards } = 1 rod (rd.)
320 rods
5280 feet
63,360 inches } = 1 mile (m.)

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4 inches = 1 hand
6 feet = 1 fathom

6086.7 feet or 1.15+ common miles } = 1 knot, 1 nautical mile, 1 geographic mile
3 knots = 1 league

Circular Measure.

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circumference
69⅙ miles or
60 geographic miles } = 1° of latitude; or 1° of longitude on the equator

Surface or Square.

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards
272¼ square feet } = 1 square rod (sq. rd.)
160 square rods
43,560 square feet } = 1 acre (A.)
640 acres = 1 square mile (sq. m.)
1 square mile = 1 section
36 square miles = 1 township
100 square feet = 1 square (in roofs, floors, etc.)

Solid or Cubic.

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

Wood Measures.

16 cubic feet = 1 cord foot (cd. ft.
128 cubic feet
8 cord feet } = 1 cord (cd.)

METRIC SYSTEM

UNITS OF LENGTH

Table		Equivalents
10 millimeters (mm.)	= 1 **centimeter** (cm.)	= 0.3937079 inch
10 centimeters	= 1 decimeter (dm.)	
10 decimeters	= 1 **meter** (m.)	= 39.37079 inches
10 meters	= 1 dekameter (Dm.)	
10 dekameters	= 1 hektometer (Hm.)	
10 hektometers	= 1 **kilometer** (Km.)	= 3280.9 feet 0.621382 mile
10 kilometers	= 1 myriameter (Mm.)	

UNITS OF SURFACE

Table		Equivalents
100 sq. millimeters (sq. mm.)	= 1 **sq. centimeter** (sq. cm.)	= 0.155 sq. in.
100 sq. centimeters	= 1 sq. decimeter (sq. dm.)	
100 sq. decimeters	= 1 **sq. meter** (sq. m.)	= 10.764 sq. ft.
100 sq. meters	= 1 sq. dekameter (sq. Dm.)	
100 sq. dekameters	= 1 sq. hektometer (sq. Hm.)	
100 sq. hektometers	= 1 **sq. kilometer** (sq. Km.)	= 247.114 acres

When used in measuring land the square meter is called a *centare* (ca.), the square dekameter an *are* (a.), and the square hektometer a *hektare* (Ha.).

UNITS OF VOLUME

Table		Equivalents
1000 cu. milimeters (cu. mm.)	= 1 **cu. centimeter** (cu. cm.)	= 0.06102 cu. in.
1000 cu. centimeters	= 1 cu. decimeter (cu. dm.)	
1000 cu. decimeters	= 1 **cu. meter** (cu. m.)	= 35.314 cu. ft.

In measuring wood the cubic meter is called a *stere* (1 st. 0.2759 cd.); a *decistere* (1 dst.) is one tenth of a stere.

UNITS OF CAPACITY

Principal unit, the Liter = a cu. decimeter.

Table		Equivalents
10 milliliters (ml.)	= 1 **centiliter** (cl.)	= 0.6102 cu. inch
10 centiliters	= 1 deciliter (dl.)	
10 deciliters	= 1 **liter** (l.)	= 1.0567 liquid quarts 0.908 dry quart
10 liters	= 1 dekaliter (Dl.)	
10 dekaliters	= 1 **hektoliter** (Hl.)	= 26.417 gallons 2.8375 bushels
10 hektoliters	= 1 kiloliter (Kl.)	

UNITS OF WEIGHT

Table		Equivalents
10 milligrams (mg.)	= 1 centigram (cg.)	= 0.15432 grain
10 centigrams	= 1 decigram (dg.)	
10 decigrams	= 1 gram (g.)	= 15.432 grains
10 grams	= 1 dekagram (Dg.)	
10 dekagrams	= 1 hektogram (Hg.)	
10 hektograms	= 1 kilogram (Kg.)	= 2.20462 pounds
10 kilograms	= 1 myriagram (Mg.)	
10 myriagrams	= 1 quintal (Q.)	
10 quintals	= 1 metric ton (T.)	= 2204.621 pounds

Table of Equivalents

Common	*Metric*	*Common*	*Metric*
1 inch	= 2.54 (cm.)	1 cu. foot	= 28.317 (cu dm.)
1 foot	= 30.48 (cm.)	1 cu. yard	= 0.7645 (cu. m.)
1 yard	= 0.9144 (m.)	1 cord	= 3.624 (st.)
1 rod	= 5.029 (m.)	1 liquid quart	= 0.9463 (l.)
1 mile	= 1.6093 (Km.)	1 gallon	= 3.785 (l.)
1 sq. inch	= 6.452 (sq. cm.)	1 dry quart	= 1.101 (l.)
1 sq. foot	= 9.2903 (sq. dm.)	1 bushel	= 0.3524 (Hl.)
1 sq. yard	= 0.8361 (sq. m.)	1 grain	= 0.0648 (g.)
1 sq. rod	= 0.2529 (a.)	1 ton	= 0.9072 (met. ton)
1 sq. mile	= 2.59 (sq. Km.)	1 troy ounce	= 31.1035 (g.)
1 Acre	= 0.4047 (Ha.)	1 av. ounce	= 28.35 (g.)
1 cu. inch	= 16.387 (cu. cm.)	1 av. pound	= 0.4536 (Kg.)

ANSWERS TO PROBLEMS

Note. — In commercial transactions final results are given to the nearest cent

Page 8

1. 718,256.
2. 616,734.
3. 288,561.
4. 635,040.
5. 292,383.
6. 763,848.
7. 554,592.
8. 476,766.
9. 3,132,357,396.
10. 5,552,697,720.
11. 1,615,246,206.
12. 6,953,620,383.
13. 3,129,273,108.
14. 3,892,111,476.
15. 2,247,790,272.

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1. $5312\frac{1}{2}$.
2. $4001\frac{1}{4}$.
3. $13{,}689\frac{3}{5}$.
4. $6957\frac{1}{6}$.
5. $15{,}135\frac{5}{8}$.
6. $8637\frac{1}{3}$.
7. $10{,}031\frac{4}{7}$.
8. $7950\frac{2}{3}$.
9. $6394\frac{1}{2}$.
10. $46{,}641\frac{3}{5}$.
11. $28{,}735\frac{2}{3}$.
12. $11{,}368\frac{1}{2}$.
13. $58{,}477\frac{5}{7}$.
14. $5001\frac{1}{3}$.
15. 2220.
16. 18,088.
17. 26,980.
18. 27,040.
19. 36,728.
20. 28,210.
21. 17,552.
22. $4193\frac{1}{3}$.
23. $14{,}369\frac{4}{7}$.
24. $14{,}725\frac{1}{3}$.
25. $17{,}407\frac{5}{7}$.
26. $19{,}596\frac{7}{8}$.
27. $37{,}589\frac{1}{2}$.
28. $23{,}628\frac{1}{2}$.

Page 17
(Multiplication)

1. $\frac{13}{108}$.
2. $\frac{2}{35}$.
3. $\frac{23}{200}$.
4. $\frac{114}{1715}$.
5. $\frac{77}{432}$.
6. $\frac{64}{357}$.
7. $\frac{4}{63}$.
8. $\frac{6}{245}$.
9. $\frac{8}{135}$.
10. $\frac{4}{165}$.
11. $\frac{5}{9}$.
12. $\frac{5}{21}$.
13. $\frac{5}{42}$.
14. $\frac{25}{41}$.
15. $\frac{8}{11}$.
16. $\frac{63}{152}$.
17. $\frac{595}{864}$.
18. $56\frac{1}{4}$.
19. 5.
20. $19\frac{1}{2}$.
21. 75.
22. $1629\frac{3}{4}$.
23. $\frac{3}{4}$.
24. $78\frac{522}{1165}$.
25. $\frac{3}{4}$.
26. $7\frac{1007}{4675}$.
27. $2\frac{87}{128}$.
28. $74\frac{1}{4}$.

(Division)

1. $9\frac{11}{51}$.
2. $\frac{1}{3}$.
3. $1\frac{59}{100}$.
4. $\frac{2}{3}$.
5. 5.
6. $3\frac{29}{42}$.
7. $5\frac{25}{28}$.
8. $\frac{17}{44}$.
9. $2\frac{1}{4}$.
10. $8\frac{1}{28}$.
11. $3\frac{1}{3}$.
12. $10\frac{5}{8}$.
13. $4\frac{1}{3}$.
14. $1\frac{19}{30}$.
15. $5\frac{25}{29}$.
16. 4.

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1. 0.21084.
2. 0.04592.
3. 0.2432.
4. 0.00064.
5. 0.99004.
6. 0.326326
7. 0.04.
8. 0.0387.
9. 3.3136.
10. 0.022454.
11. 0.000152.
12. 8.26281.
13. 1.0685.
14. 3.2.
15. 213.33 +.
16. 24.4375.
17. 38.52.
18. 14.72 +.
19. 3.0476 +.
20. 0.5979 +.
21. 0.3728 −.
22. 1.0959 −.
23. 79.16 +.
24. 93.33 +.

Page 21

1. 1329.3.
2. 791.3.
3. 197.8.
4. 59.5.
5. 1813.3.
6. 84.3.
7. 1523.5.
8. 125.9.
9. 137.2.
10. 6672.0.

1. 2.2.
2. 126.1.
3. 8.8.
4. 22.5.
5. 241.2.
6. 53.4.
7. 7.5.
8. 4.3.
9. 81.5.
10. 49.1.
11. 54.4.
12. 17.0.
13. 2.5.
14. 0.02.
15. 0.4.
16. 20.4.

Pages 22–24

1. 11 yd., 1 ft., 2 in.
2. 18 lb., 4 oz.
3. 14 gal., 1 qt.
4. 38 ft., 1 in.
5. 43° 26′ 57″.
6. 118 bu.
7. 6 gal., 2 qt., 1 pt.
8. 27 rd., 3 yd., 3 ft., 6 in.
9. 5 bu., 1 pk., 5 qt.
12. 67° 51′ 36″.
13. 125° 10′.
14. 40 gal., 1 qt.
15. 105 bu., 3 pk.
16. 126 hr., 24 min.
17. 177 lb., 12 oz.
18. 33 bu.
19. 96 bu., 1 pk.
20. 25 bu., 2 pk., 6 qt.
21. 2 mi., 144 rd., 4 yd., 1 ft., 2.4 in.
22. 1 wk., 6 da., 23 hr., 12 min.
23. 4 hr., 57 min., $7\frac{13}{15}$ sec.
24. 82° 30′ west.
25. 2:23 P.M. 9:37 A.M.
26. 130° 7′ 30″.
27. 103 in.
28. 58 oz.
29. 8760 cu. in.
30. 3417 min.
31. 88 sq. ft.
32. 3228 min.
33. 2.452 mi.
34. 1.985 wk.
35. 4.951 hr.
36. 82.5°.
37. 2.366; 9.666.
38. 130.125°.
39. 0.1014.
40. 0.1354.
41. 216°.
42. 257° 8′ $34\frac{2}{7}$″.
43. 0.1338 +.
44. 6; 5 ft., 6 in.
45. 4 ft., $2\frac{1}{2}$ in.

Pages 26–27

1. 847,200 g.; 1867.75 lb.
2. 26.43 hl.
3. 16.72 sq. m.
4. 1312.36 yd.
5. 395.38 sq. rd.
6. 1000 liters.
7. $ 10.63 gain.
8. 960 kg.
9. 88.9 kg.
10. 28,451.84 m.
11. $3.31.
12. 56 Ha., 138.32 A.
13. 264 gal.
14. 800.
15. $3.21.
16. 196.87 kg.
17. 4.66 miles; 7500 m.
18. 1111.32 kg.
19. 252 kl.; 252,000 kg.; 252 metric T.
20. 198.84 miles.
21. 45.02 miles.
22. 56 ft., 2.33 in.
23. 106.68 cm. × 96.52 cm.
24. $98.81.
25. 193.12 km.
27. $32.18 gain.
28. $2.51.
29. 93.57 m.

Pages 28–30
(Oral)

1. 96¢; $10\frac{1}{2}$ yd.
2. $8.40.
3. $\frac{5}{12}$ jute; 150 lb. flax; 200 lb. hemp; 250 lb. jute.
4. $5.04.
5. $16\frac{5}{8}$ yd.
6. 6 aprons.
7. 86 yd.
8. $ 24 per ton; $ 258.
9. $28.
10. $\frac{8}{10}$ ton.
11. 22 bu.; $19.80.
12. $24; $3.
13. 70 bu.
14. 160 bu. per acre; 920 bu.
15. $15\frac{1}{8}$ yd.; $ 3.63.
16. $6 gain.
17. $\frac{1}{7}$ more.
18. $17,000.
19. 50¢ gain; $3 cost.
20. $147; $98.
21. $35.
22. $21,600.
23. $24.
24. $3.60.
25. $420.
26. 6 hours.
27. $9 suit; $ 6 overcoat.
28. 1480 gal.
29. $\frac{1}{5}$.
30. $32.

Pages 30–33
(Written)

1. $1.56.
2. 630 bu.
3. $123.33.
4. $15\frac{1}{2}$ in. wide; $5\frac{1}{4}$ yd. long.
5. (*a*) $53\frac{9}{20}$ T.; (*b*) $2672\frac{1}{2}$ T.; (*c*) $248.54; (*d*) $1553.38.

6. 21 strokes;
31 strokes;
14 strokes.
7. 65.48+ lb. per square inch.
8. $\frac{7}{24}$ left.
9. $1200.
10. 7210 lb.
11. 27,688 lb.
12. 129 miles.
13. $\frac{1}{12}$ gain.
14. $\frac{13}{15}$.
15. $24.
16. 496 lb.;
$66.34.
17. $156.19.
18. $37.18.
19. $$0.62\frac{1}{12}$.
20. 720 sheep;
$1293.75;
$1928\frac{4}{7}$ lb.
21. 43.
22. $1\frac{1}{16}$ in.
23. $540 gain.
24. $1309.59.
25. 64.
26. 261,970,000 lb.
27. 180; 480.
28. 625; 675.
29. $13.40.

Page 33 (Oral)

1. 0.66.
2. 0.88.
3. 0.5; 0.75; 0.40;
$0.62\frac{1}{2}$; 0.60;
$0.87\frac{1}{2}$; $0.33\frac{1}{3}$;
$0.66\frac{2}{3}$; $0.83\frac{1}{3}$.
4. $\frac{1}{2}$; $\frac{4}{5}$; $\frac{4}{25}$; $\frac{6}{25}$, $\frac{1}{4}$;
$\frac{1}{8}$; $\frac{21}{25}$; $\frac{24}{25}$.
5. 0.28.

Page 34 (Written)

1. (*a*) $0.583\frac{1}{3}$;
(*b*) $0.708\frac{1}{3}$;
(*c*) 0.865;
(*d*) 0.156.
2. 199.73 mi.
3. 2814.72 lb.
4. $395.99.
5. $463.99.
6. $236.10.
7. $339.86.
8. $240.96.
9. $541.31.
10. 49.93 lb.
11. 3186.65.
12. 612.
13. 21,610 lb.
14. 172.8°.
15. 18.9 ft.
16. 1980 ft.
17. $5.76.

Pages 35–36 (Oral)

2. $\frac{6}{100}$ of it.
3. 0.20; $\frac{20}{100}$.
4. $16; $64.
5. $720.
6. 12 days.
7. 84 %.
8. 25 %.
9. 1200 lb.
10. 2 tons.
11. $66\frac{2}{3}$ %.
12. 55 %.
13. 25 % and $125.
14. $400.
15. $7200.
16. $960.
17. $4.20.
18. $19.20.
19. 40 %.
20. 672 bu.
21. $12\frac{1}{2}$ %.
22. 300 eggs.
23. 25 %.

Pages 37–38 (Written)

1. $8500.
2. $16,500.
3. $2.81.
4. $2.07 and $76.95.
5. $79.93.
6. $33\frac{1}{3}$ %.
7. $338.60 and $1185.10.
8. $4708.13.
9. 48.14+ %.
10. $158.22.
11. $72.96.
12. $17.75.

Page 38 (Oral problems)

1. $600.
2. $2600.
3. $820.
4. $1200.
5. $375.
6. $300.
7. $1230.
8. $1600.
9. $400.
10. $900.
11. $2000.
12. $1800.
13. $700.
14. $300.
15. $70.
16. $240.
17. $2400.
18. $500.
19. $700.
20. $1200.
21. $3250.
22. $1560.
23. $450.
24. $700.

Page 39 (Oral)

1. $3.60 gain;
$15.60 S. P.
2. $\frac{1}{5}$; 20 %.
3. 0.80 gain;
$2.80.
4. $1.20 gain;
$\frac{2}{5}$; 40 %.
5. $16; $\frac{1}{2}$; 50 %
6. $36.
7. 25 %.
8. 20 %.

Page 39 (Drill table)

1. 10 %.
2. $83\frac{1}{3}$ %.
3. 25 %.
4. 500 %.
5. 50 %.
6. $16\frac{2}{3}$ %.
7. 120 %.
8. 150 %.
9. $16\frac{2}{3}$ %.
10. 25 %.
11. 50 %.
12. $14\frac{2}{7}$.
13. $12\frac{1}{2}$ %.
14. $11\frac{1}{9}$ %.
15. $14\frac{2}{7}$.
16. $33\frac{1}{3}$ %.

17. 50%.
18. $16\frac{2}{3}$%.
19. 25%.
20. 25%.

Page 40 (Oral)

9. 20%.
10. $\frac{1}{6}$; $16\frac{2}{3}$%.
11. $\frac{1}{3}$; $33\frac{1}{3}$%.
12. 20%.
13. 25%.
14. 80%; 125%.
15. \$20.
16. \$30.

Pages 40–42 (Written)

1. $61\frac{1}{9}$%.
2. \$5662.50.
3. \$68,000.
4. \$5725; 8.72%.
5. 20%.
6. 255%.
7. \$48,720.
8. $12\frac{2}{9}$%.
9. $37\frac{1}{2}$%.
10. $11\frac{11}{32}$%; 6.8%+.
11. \$450.78.
12. 10.7%+.
13. \$0.38.
14. \$5.625;
    15.78%.
15. 20%.
16. 51.14%.
17. $30\frac{2}{3}$%.
18. 1st $2\frac{5}{8}$% better.

Page 42 (Oral)

1. \$72.
2. 20%.
3. \$1120.
4. 25%.
5. \$120.

Page 43 (Drill table)

1. \$30.
2. \$52.
3. \$100.
4. \$500.
5. \$800.
6. \$157.50.
7. \$375.
8. \$640.
9. \$220.
10. \$560.
11. \$600.
12. \$480.
13. \$800.
14. \$360.
15. \$1000.
16. \$540.

Pages 43–44 (Written)

1. \$292.50.
2. 35%.
3. 20%.
4. \$1650.
5. \$471.87.
6. 25%.
7. 22%.
8. \$630.
9. \$407.43.
10. \$7.80; $13\frac{1}{3}$%.
11. \$206.85;
    \$10.34.
12. \$472.76.

Page 44 (Drill table)

1. \$93; \$372.
2. \$323.33;
   \$646.67.
3. \$656;
   \$984.
4. \$91.50;
   \$1738.50.
5. \$49; \$1911.
6. \$173.50;
   \$3296.50.
7. \$283; \$1415.
8. $10\frac{2}{19}$%; \$854.
9. $16\frac{2}{3}$%; \$875.
10. $16\frac{2}{3}$%; \$210.
11. $2\frac{1}{2}$%; \$916.50.
12. 5%; \$31.50.
13. $14\frac{2}{7}$%; \$18.
14. \$945; 25%.

Page 45 (Oral)

1. \$270.
2. \$200.

Page 45 (Table I)

3. \$432.
4. \$540.
5. \$510.
6. \$800.
7. \$960.
8. \$1620.
9. \$2100.
10. \$1140.
11. \$2940.
12. \$4860.

(Table II)

13. \$1000.
14. \$200.
15. \$2000.
16. \$3000.
17. \$300.
18. \$1500.
19. \$700.
20. \$3000.
21. \$400.
22. \$400.

Pages 45–46 (Oral)

23. 19%.
24. 28%.
25. 40%.
26. 55%.
27. 60%.
28. 55%.
29. 70%.
30. 40%.
31. 52%.
32. 68%.
33. 70%.
34. 37%.
35. 50%.
36. 30%.
37. 49%.
38. $52\frac{1}{2}$%.
39. $62\frac{1}{2}$%.
40. 70%.
41. 65%.
42. 70%.
43. 70%.
44. 58%.
45. 50%.
46. 44%.
47. 56%.
48. 40%.
49. 48%.
50. 84%.
51. 91%.
52. 79%.
53. 76%.
54. 75%.
55. $77\frac{7}{9}$%.

Pages 46–47 (Written)

1. $51.84.
2. $48.45.
3. $12.38.
4. $19.46.
5. $62.05.
6. $459.
7. $229.16.
8. $424.69 ; $336.71 ; 79.28 %.
9. 47.21 %.
10. 33.7 %.
11. $37.80.
12. $510.72 ; $25.54.
13. $1.67 dealer ; $4.16 agent.
14. Discount with A = $72.50.

Pages 48–50

1. Yes ; $8.80.
2. $10.63.
3. $188.70 ; $190.61.
4. $31.85 ; $32.50.
5. $73.74 ; $75.25.
6. $31.66 ; $32.31.
7. $53.66 in 60 da. ; $52.59 in 10 da.
8. $337.62 in 4 mo. ; $320.74 in 30 da.

Pages 51–52 (Oral)

1. 12½ ¢ gain.
2. 31¼ ¢ gain.
3. 25 ¢ gain.
4. 28 ¢ gain.
5. 26 % gain.
6. 8 % gain.
7. 10 % loss.
8. 12 % gain.
9. 60 ¢ gain.
10. 50 % gain.
11. 66⅔ % above cost.
12. 33⅓ %.
13. $700 ; 20%.

Page 52 (Drill table)

1. $0.70 ; $4.20 ; $3.78 ; $0.28.
2. $1.90 ; $9.50 ; $8.31 ; $0.71.
3. $3.50 ; $14 ; $13.65 ; $3.15.
4. $1.20 ; $4.80 ; $4.32 ; $0.72.
5. $1.60 ; $11.20 ; $10.64 ; $1.04.
6. $3.28 ; $19.68 ; $18.11 ; $1.71.
7. $9.92 ; $34.72 ; $26.04 ; $1.24.
8. $7.43 ; $23.93 ; $19.94 ; $3.44.
9. $8.60 ; $25.80 ; $22.57 ; $5.37.
10. 20 % gain.
11. 26 % gain.
12. 16⅔ % gain.
13. 25 % gain.
14. 20 % gain.
15. 5 % gain.
16. 22½ % gain.
17. 38 % gain.
18. 4 % gain.
19. 4 % gain.
20. No gain or loss.
21. 5 % gain.
22. 2½ % loss.
23. 10⅔ % gain.
24. 4⅙ % gain.
25. 6⅔ % gain.
26. 4 % loss.
27. 20 % gain.

Page 53 (Oral)

1. $4500 ; $2700.
2. $60,000.
3. 10 %.
4. $2.10 ; $105.
5. $3400.
6. $6250.
7. $6000.
8. $6000.
9. $7200.
10. $6900.
11. $11,875.
12. $2100.
13. $9750.
14. $5760.
15. $18 ; $0.036.
16. $7.20 ; $0.01 ; $0.65.

Pages 54–55 (Written)

1. $17.50 ; $0.03½.
2. $246.17.
3. $34.80.
4. $561.15.
5. $40.55 ; 8.55 %.
6. $327.20.
7. $123.40.
8. $415.83.
9. $2403.97 ; $379.97.

Page 56 (Written)

1. $3437.50 ; $125.
2. $1837.50 ; $75.
3. $168,175 ; $350.
4. $5880 ; $280.
5. $63,210.

Pages 56–58 (Oral problems)

1. $6 ; $106 ; $103 ; $109.
2. $25 ; $37.50.
3. $848.
4. A promissory note.
5. $350 face ; W. B. Howe ; June 10, 1910 ; E. A. Thompson ; 6 % ; December 10 ; $10.50 ; $360.50.
6. $\frac{6}{100}$; $\frac{1}{100}$ for 60 da. at 6 %.
7. $6.50 ; $12.50 ; $15.75 ; $25 ; $17.60 ; $340 ; $84 ; $38.65.

8. $4; $4.80; $3.60; $6.25; $8.40; $18.20; $6.22½; $31.50; $22.50.
9. $8; $7.50; $16; $35.60; $28.40; $57.60; $84.60.
10. $9.
11. $15.
12. $9.
13. $4.
14. $1.20.
15. $2.70.
16. $1.60.
17. $4.
18. $9.
19. $105.
20. $39.
21. $120.
22. $17.60.
23. $40.
24. $49.
25. $21.
26. $40.
27. $18.75.
28. $23.
29. $24.53.
30. $42.93.
31. $330; $660; $165; $82.50; $110; $495.
32. $60; $5; $30; $15; $75; $105; $150.
33. $270; $450; $360; $540; $315; $1102.50.
34. $12.50.
35. $10.
36. $12.50.
37. $18.75.
38. $66.
39. $27.50.
40. $44.
41. $49.50.
42. $77.
43. $154.
44. $1062.50.

Pages 59–60 (Written)

2. $312.50; $5312.50.
3. $402.67; $6442.67.
4. $731.25; $8231.25.
5. $302.72; $9762.72.
6. $48.75; $1398.75.
7. $121.10; $3581.10.
8. $48.60; $4908.60.
9. $63.19; $6563.19.
10. $19.25; $1419.25.
11. $43.72; $3093.72.
12. $46.04; $5146.04.
13. $15.60; $1965.60.
14. $39.20.
15. $95.60.
16. $21.40.
17. $4.60.
18. $1.49.
19. $337.50.
20. $6.49.
21. $1.25.
22. $1.38.
23. $0.67.
24. $20.90.
25. $50.
26. $5.83.
27. $0.23.
28. $280.
29. $15.59.
30. $8.14.
31. $45.
32. $461.67.
34. $18.82.
35. $16.80.
36. $7.48.
37. $13.86.
38. $26.04.
39. $28.88.
40. $8.90.
41. $13.44.
42. $8.59.
43. $27.36.
45. $7.97.
46. $8.31.
47. $9.30.
48. $8.75.
49. $11.45.
50. $1.25.
51. $0.83.
52. $5.19.
53. $4.06.
54. $8.44.
55. $9.33.

Page 61 (Oral)

1. May 11, 1910.
2. $9.
3. $591.
4. $6; $3; $1.
5. $1260; $12.60; $6.30; $18.90; $1.26.
6. $1590.
7. $1574.10; $1566.15; $1558.20; $1578.07.

Pages 62–63

1. $397.33.
2. $986.54.
3. $1272.
4. $1233.84.
5. $1214.76.
6. $1251.23.
7. 9%.
8. $448.40.
9. $715.20.
10. $949.02.
11. $601.19.
12. $4.35; $562.65.
13. $6462.62.
14. $808.39.
15. 60 day note at 6% is $7.50 less; 90 day note at 6% is $3.75 less.
16. $533.07; $534.60; $537.39.

Pages 64–66 (Oral)

1. Acme Portland Cement Company; State of Michigan, $200,000.

2. $100; 2000.
3. B. N. Mason; 50; $5000; $300.
4. $2500.
5. 500; 1000; 5000.
6. $135¼; $1352.50.
7. $86.50; $43.25; $432.50.
8. $163½; $1635; $1.25.
9. $16; $160.
10. 6%; $60.
11. 8%; $200.
12. $200.
13. $500; $2000.
14. 50; $6000.
15. 20; $1840.
16. 10%; $8, or 4%.
17. 8%.
18. $200; 199⅞.
19. 50.
20. $120; $20; 16⅔%.
21. $10; $47.50.
22. 74¼.
23. 81⅞.

Pages 66–68 (Written)

1. $5022.50.
2. $1977.50.
3. 192 shares.
4. 12½%.
5. 81; $88.125.
6. 24.
7. 40.
8. $4850.
9. $181,250.
10. 800.
11. $6265; $400; 6.38%.
12. $3096.
13. $811.46; $2743.10.
14. $1415.50.

Pages 68–70 (Oral and Written)

2. $2080; $2000; $80.
3. $975; $1000.
4. $9000.
5. $150.
6. $500.
7. 30.
8. $30 per $1000 Bond.
9. $400; $500; $20; $30; 7½%.
10. The first.
11. Argentine $960.
Rep. of Cuba $1032.50.
U.S. of Mexico $943.75.
Am. Tobacco $1070.
Armour & Co. $945.
Balt. & Ohio $926.25.
Cent. of N.J. $1246.25.
C. B. & Q. $966.25.
C. M. & St. P. $1002.50.
Iowa Cent. $1070.
P. & M. $788.75.
St. P. & M. M. $893.75.
St. L. & S. W. $932.50.
Va. & S. W. $981.25.
12. $50; $40; $50; $40; $40; $50; $60; $40; $45; $45; $40; $40; $50; $50.
13. $5000; $5400.
14. $500; $490.
15. $30,000; $30,600.
16. $5200.
17. $16,000; $17,600.
18. 5%.
19. 5%.
20. 4½%.
21. $1600.
22. $1050.
23. $800.

Pages 70–71 (Written)

2. $80.
3. $27,673.
4. $25,820.
5. $71,240.
6. $721,426.
7. $725,935.
8. $411,272.75.
9. $25 on a thousand.
10. $2 on a thousand.
11. $66⅔ on a thousand.
12. $76.92 on a thousand.
13. $14.71 on a thousand.
14. $12.86 on a thousand.
15. $6⅔ on a thousand.
16. $12.56 on a thousand.
17. $17 on a thousand.

Pages 71–72 (Oral)

2. $225; $3000.
3. $3000.
4. $1000.
5. $1400.
6. $5400.
7. $150.
8. $750.
9. $32,000.
10. 10%.
11. 5%.
12. $210.
13. 1¼%.
14. $6400.

Page 72 (Written)

1. $15,843.75.
2. $23,333.33.

3. $2400.
4. $1,500,000.
5. $104,000.

Pages 74–75

15. July 5; 56 days.
16. $574.59.
17. $573.14.
20. $493.75.
21. $490.
22. $10.25; first.
24. $151.14.
25. $147.50.
26. $114.17.
27. $197.45.
28. $80.97 cash.
29. $101.75 net.

Pages 77–81 (Miscellaneous)

1. 52%; $44,200; $2160.
2. $1182.
3. $3.21.
4. $3.24.
5. $6250.
6. $500.
7. $810.62.
8. $409.50.
9. $656.25.
10. $226,200; $150,800.
11. 63%; $1554.
12. 23.7 bu. per acre.
13. 12%+; 21.9%; 25.05%.
14. $6500; $7800.
15. $212,784.
16. $50.85.
17. $325.
18. 3 yr. 4 mo.
19. 4%.
20. $1677.08.
21. $522.50.
22. $2400.
23. $73.50.
24. $11,200.
25. $3960.
26. $.006.
27. $35,505.
28. 3 yr. 6 mo.; 5%.
29. $39.
30. 5%.
31. 54%.
32. $180.
33. $54.
34. $330.
35. $5616.07; $6739.28.
36. $116.89.
37. $4974.38; $13,573.13.
38. $5.30.
39. $11,380.36; $13,656.43.
40. $961.98; $1.80.
41. $.25+.
42. $7005.60.
43. 654.9 lb.
44. $7.67; $1088.53.
45. $276.42.

Pages 81–82 (Oral)

1. 9, $\frac{3}{2}$, $\frac{11}{2}$, 25, 100.
2. .09, .0009.
3. 11 in.
4. 3.
5. 4 in. by 12 in.
6. 160 rd.
7. 24; $1\frac{1}{5}$; $1\frac{1}{7}$; $\frac{4}{11}$; 10.1; 2.5; 1.1; 1.2; $1\frac{4}{9}$; 15+; 15, 8+; $1\frac{1}{4}$; $1\frac{1}{2}$; $1\frac{2}{3}$; $2\frac{1}{3}$; 10.2; 2.1; 5.5; 3+.

Page 82 (Written)

1. 280.
2. 55.
3. 147.
4. 219.
5. 167.002.
6. 279.
7. 335.
8. 447.
9. 391.
10. 1455.
11. 5.5.
12. 0.033.
13. 0.0094.
14. 0.111.
15. 1.68.
16. 24.3.
17. 25.90.
18. 3.92.
19. 0.17677.
20. 4.47.
21. $\frac{24}{25}$.
22. $\frac{42}{61}$.
23. $\frac{31}{32}$.
24. $\frac{4}{55}$.
25. $\frac{3}{43}$.
26. $\frac{17}{75}$.
27. $\frac{44}{63}$.
28. $\frac{11}{109}$
29. $\frac{2}{11}$.
30. $\frac{13}{25}$.
31. $13\frac{1}{2}$.
32. $4\frac{1}{3}$.
33. $2\frac{22}{27}$.
34. $2\frac{5}{9}$.
35. $2\frac{5}{9}$.
36. 2.045+.
37. $3\frac{1}{2}$.
38. $1\frac{27}{29}$.
39. $2\frac{18}{35}$.
40. $2\frac{11}{23}$.
41. 3.9 min
42. 117.
43. 10.299.
44. 400 rd.
45. $187.20.
46. $21\frac{9}{11}$ rd.

Pages 83–84 (Written)

2. 1144 sq. ft.
3. 1200 sq. yd.
4. 56 yd.
5. 5400.
6. $42.
7. 1440.
8. $17\frac{1}{2}$ A.
9. $28,233.33.
10. 160.
11. $18\frac{2}{3}$ yd.
12. 7 strips, $6\frac{2}{3}$ yd., $46\frac{2}{3}$ yd., $58.33.
13. 2200 sq. rd.; $13\frac{3}{4}$ acres.
14. 5.51 acres.
15. $113.89.

16. $3024.
17. 1920 bricks.
18. $30.21.
19. 1250 tiles.
20. 8800 yd.
21. 62.7 sq. ft.; $188.10.
22. $44.55.
23. 11,962.5 sq. ft.
24. 992.2 sq. ft.

Pages 85–86 (Written)

2. 60 ft.
3. 68 ft.
4. 57 ft.
5. 115 ft.
6. 42.42 ft.; 25.61 in.
7. 8.6 ft.
8. 56.5 rd.
9. 223.6 rd.
10. 61.4 rd.
11. 20.7 ft.
12. 131½ sq. in.
13. 27.1 ft.
14. 2368 ft.
15. 78.1 ft.
16. 58.3 ft.
17. 31+ ft.

Pages 86–87 (Written)

1. 3.1416 times as great.
3. 2.54 ft., approx.
4. 720.28 revolutions.
5. 5.4978 sq. in.
6. $61.09.
7. 7.63 revolutions per minute.
8. 114.59; 95.49; 76.39.
9. 25,133 mi., approx.; 1047 mi. an hr. (approx.)
10. 4½ by 12⅘ in.

Pages 88–90 (Written)

1. 5 ft.
2. 75.3984 sq. in.; 100.5312 sq. in.; 75.3984 cu. in.
3. 646.1 sq. cm.
4. 1224 bu.; 73,440 lb.
5. 249 cu. yd.; $87.15.
6. $95.41.
7. $84.38.
8. 3 cords.
9. 4.59 in., approx.
10. 201.062 cu. in.
11. 23.56 cu. yd.
12. 5229 cu. yd., approx.
13. 3380.5 gal., approx.
14. $205.62.
15. 1570.8 sq. ft.
16. 104.72 lb.
17. 505.31 lb.
18. 514 2/7 gal.
19. 243 tons.
20. 1445 sq. ft.; 94,828⅛ lb.
21. 350 lb.
22. 54,287 gal.
23. 15-in. can holds 1⅛ times as much.
24. 14.6 lb.
25. 11,998 gal.
26. 88.12 lb.
27. 4.5 in.

Pages 90–91 (Oral)

1. ⅓; 186⅔ cu. ft.
3. 4 times as great.
6. ⅔ of it.
7. 12 cu. in.
8. 3.
9. ⅔ of it.

Pages 91–92 (Written)

1. 47.64% shavings; 52.36% remains.
2. 33.5104.
3. 235.62 lb.
4. 1.1054 lb.
5. 4,188,800,000 cu. mi.
6. 64.
7. 67.0208.
8. Curved surface is twice flat surface.
9. 78.54 sq. in.; 15,708 in.
10. 113.0976 sq. in.
11. 155.4588 oz.
12. 12,566,400 sq. mi.
13. 72.08 lb.
15. 8.8 in.; 0.6 in.

Pages 93–94 (Written)

1. 437.5 lb.; 168.8 lb.; 156.3 lb.; 1206.3 lb.; 656.3 lb.
2. 2.5 cu. ft.
3. 10.06 cu. ft.
4. 405 lb.; 3375 lb.
5. 85.6 lb.
6. 6.6 lb.; 5.8 lb.
7. 258.75 lb.
8. 204.8 tons.
9. No.
10. 3.
11. 1.58 oz.
12. 272 grams.
13. 975 lb.
14. 14.1 lb.
15. 1820 lb.
16. 2180.2 lb.
17. 99+ lb.
18. 239 lb.; 3 in.
19. 8.8 in.
20. 273.38.
21. 2.8 lb.
22. 70,170 lb.

Pages 94–99

1. 4 A.
2. $3960.
3. 74½ ft.

4. $180.
5. 5.5 A. nearly.
6. 633,600.
7. 16,900 sq. ft.
8. $\frac{8}{9}$ of sq. yd.
9. $.80.
10. $55.50.
11. 288,000 ft.
12. $7368.89.
13. 4 strips; $4\frac{2}{3}$; $4\frac{1}{3}$; 5.
14. $13.69.
15. $18.
16. $264.
17. $144\frac{1}{4}$ sq. ft.
18. $59\frac{1}{3}$ yd.
19. 180.
20. $60.
21. $88.
22. $31.25.
23. $76.
24. $52.50.
25. $45.75.
26. 465 sq. ft.
27. $74\frac{3}{8}$ sq. in.
28. 6125 sq. ft.
29. 98 sq. in.
30. 330.6 sq. rd.
31. 16 sq. ft. less.
32. 714 sq. in.
33. 25 sq. rd.
34. $2.56.
35. $\frac{1}{8}$ as much.
36. $20\frac{5}{8}$ lb.
37. 1280 bu.
38. 21 sq. ft.; 252 cu. ft.
39. $18.28.
40. 500 lb.
41. $859\frac{3}{8}$ lb.
42. $35.88.
43. 5445 cu. ft.
44. 14,080 bricks.
45. $55.73.
46. $4.35.
47. $716.80.
48. 1224 bu.; 73,440 lb.
49. 11+ gal.
50. 589.05 sq. ft.
51. 18,095.62 lb.
52. 28.06 lb.
53. 4 ft. 1 in.
54. 62,668.8 lb.
55. 5 ft., 5.3 in.
56. No.
57. 27,417.6 lb.
58. 6798 gal.
59. 1413.72 lb.
60. 1,353,646+ gal.
61. 10+ T.; 11,515 gal. about $531.
62. About 183°.3+.
63. 7.16°.
64. 1649.34 sq. ft.
65. 525,000 liters.
66. 2.23+ ft.

Page 100

1. 36 yr.; $\frac{1}{3}$; 3.
4. $\frac{1}{3}$.
5. $\frac{1}{9}$.
6. 6.
7. $11\frac{1}{2}$.
8. $\frac{1}{8}$.
9. $\frac{1}{3}$.
10. 32.
11. $\frac{1}{4}$.
12. $\frac{1}{72}$.
13. $\frac{1}{9}$.
14. $\frac{1}{5}$.
15. $\frac{1}{4}$.
16. 8.
17. $\frac{7}{16}$.
18. 60.
19. $\frac{1}{3}$.
20. $\frac{2}{11}$.
21. 4.
22. $\frac{5}{12}$.
23. $2\frac{1}{3}$.
24. $1\frac{7}{8}$.
25. $\frac{7}{30}$.
26. $\frac{5}{14}$.
27. 9.
28. $\frac{1}{12}$.
29. 4.
30. $\frac{3}{8}$.
31. $\frac{1}{25}$.
32. $\frac{1}{8}$.
33. $\frac{1}{24}$.
34. $3\frac{1}{3}$.
35. $\frac{1}{3}$.
36. $\frac{3}{5}$.
37. 5.
38. 6.
39. $\frac{1}{6}$.
40. 3.
41. $\frac{1}{12}$.
42. $\frac{8}{15}$.
43. $\frac{9}{14}$.
44. $\frac{4}{5}$.
45. $\frac{2}{3}$.
46. 1.
47. 10.
48. 15.
49. $\frac{7}{18}$.
50. $2\frac{2}{7}$.
51. $\frac{3}{8}$.
52. 24.
53. $\frac{9}{20}$.
54. $1\frac{5}{7}$.
55. $2\frac{2}{3}$.
56. $\frac{1}{352}$.
57. $\frac{2}{45}$.
58. $\frac{5}{11}$.
59. $1\frac{7}{57}$.
60. $\frac{1}{31}$.

Pages 101–103

9. 80.
10. 9.
11. 1.
12. 20.
13. $\frac{4}{5}$.
14. 65.
15. $43\frac{1}{2}$.
16. $3\frac{5}{16}$.
17. $\frac{3}{8}$.
18. $22.50; 3; 3; 3.
19. $\frac{1}{4}$; $260.
20. $\frac{1}{5}$; $6.25.
21. $\frac{1}{6}$; $432.
22. $\frac{1}{9}$; $20\frac{1}{4}$ hr.
23. 1925 T.; 7.
25. Greater.
26. $632.
27. $22.68.
28. 1363 mi.
29. $416; $544.
30. $9; $15.
31. $70; $30.
32. 30; 3 : 5 = 18 : 30.
33. 14.7 knots.
34. $\frac{1}{9}$.
35. 2 yr.
36. $\frac{1}{9}$; $\frac{1}{9}$; $\frac{1}{9}$.
37. $\frac{25}{36}$; $36.
38. $100.
39. Correct.
40. None; none; none.

41. 48 yd.
42. 14 rev.
43. 19,800 lb.
44. 416 bu.
45. $345.60.
46. $16,000; $24,000.

Pages 104–112

1. $102.
2. 1944.
3. 22$\frac{1}{2}$%.
4. $39.38.
5. $235.
6. 19.56 ft.
7. 3686.4.
8. 41° 22′ 30″ W.
9. 153 sq. ft.
10. $1050.
11. $30.86.
12. $151.50.
13. 8 ct.
14. 3562.57+ Kgm.
16. 4%.
17. 87$\frac{1}{3}$.
18. $864.27.
19. 261.
20. $\frac{1}{14}$; $\frac{7}{100}$.
21. $\frac{1}{20}$; 8; $\frac{1}{32}$.
22. 90 and 18.
23. $1173.75.
24. $11.55.
25. $12.93.
26. $450.
27. $8.66.
28. $640.
29. $2.20.
30. $56.53.
31. 7.7256.
32. 8.
33. $27,531.25.
34. $1552.37.
35. $1516.62.
36. 17.7+ in.
37. 73.5.
38. 17.36 lb.
39. $2011.78.
40. $10.28.
41. $97.63.
42. 4.74 dm.
43. 0.6334.
44. 702.9+ rev.
45. 34.4%.
46. $1299.41.
47. $2.81.
48. $450; $7500.
49. 28 ft., 11 in.
50. 4747+ T.
51. Nearly 30 in.
52. 58$\frac{2}{11}$ gal.
53. $405.50.
54. $5853.
55. $1538.27.
56. $498.50.
57. 4500 bu.
58. $71.60.
59. $657.60.
60. $216.38.
61. $112.91.
62. $755.25.
63. 916$\frac{2}{3}$ cu. yd.
64. 4.28%.
65. $1.62.
66. $\frac{1}{2}$.
67. $3700.
68. $1029.98.
69. £200 13*s.* 7.29*d.*
70. $395.25.
71. $150.
72. $742.50.
73. $220.
74. $3375.
75. $6761.495.
76. $9500.
77. $33.45.
78. $5744.90.
79. $382.50; $8988.75.
80. $6033.94.
81. 10%.
82. $5265.
83. 25%.
84. $517.50.
85. $4339.18.
86. $966.
87. $2320.
88. $560.63.
89. 77.7+%.
90. $15 on $1000.
91. 16%.
92. 48 ft.
93. 4 rd.
94. 7 ft.
95. 7 lb. copper; 14 lb. antimony; 154 lb. tin.
96. 2 : 1.
97. 12.5664 sq. in
98. 4$\frac{1}{2}$.
99. 3711 sq. ft.

Examination Questions

I

1. $250.10.
2. 884 bu., 1 pk.
3. (*a*) $\frac{61}{91}$; (*b*) $\frac{5}{9}$.
4. 12.
5. $1319.25.
6. $19,700.
7. $32.40.
8. 6$\frac{1}{4}$%.
9. 299.
10. $858.57.

II

1. $4896.
2. $13.38.
3. (*a*) 78.4; (*b*) 0.85; 0.375; 0.5625.
4. 23$\frac{12}{37}$ lb.
5. 45.
6. $532.80.
7. 1500 lb.; 200 lb.; 300 lb.
8. 12.
9. $166.45.
10. $5023.57.

III

1. 3249.
2. $12.50.
4. 50%.
5. $8.40 per $1000; $72.40.
6. $28,821.
7. $3900; $5200
8. $1562.22.

9. 750.
10. 48 ft.

IV

1. $1\frac{37}{54}$.
2. $\frac{1}{4}$ of it.
3. $\frac{5}{7}$.
4. 100.
5. $74.70.
6. $35.
7. $105.
8. $27.31.
9. $36\frac{3}{4}$ yd.
10. $42.50.

V

3. 1.04166+.
4. $112.50.
5. $160.
6. $6178.17.
7. $1186.33.
8. 160.
9. 5890.5 sq. ft.; 157.08 ft.
10. 800 sq. in.

VI

1. 1.242.
2. 132.73 +.
3. 34 min., $31\frac{1}{3}$ sec. past 8 A.M.
4. $135 gain.
5. 1st, $6.20 more.
6. 180.
7. $457.89.
8. $43,682.50.
9. 45 ft.
10. $3897.56.

VII

1. 1st by $1.11.
2. 2.
3. 45 mi.
4. 317.2.
5. 11%.
6. $202.50 gain.
7. $34.08.
9. $33.55.
10. 0.075.

VIII

1. 30%.
2. $7.41; $867.59.
3. $3.72.
4. $476.77.
5. $6300.
6. $200.
7. $22.89.
8. 8° 50′ 22″ E.
9. 8%.
10. 31.24 in.

IX

2. $155.80.
3. 35% is better.
4. $642.60.
5. 5 yr., 4 mo., 3 da.
6. $1020.
7. $284.38; $2784.38.
8. $154.80.
9. $282.
10. 8%.

X

1. $45.
2. $1197.
3. 11.
4. 3392 ft.
5. $210.
6. $5\frac{5}{8}$ cd.
7. $11.64.
8. $152.
9. $367.50.
10. $714.

XI

1. $9\frac{1}{5}$.
2. 50 rd., 3 ft.
3. 133 bu.
4. $162.
5. $1260.
6. $2\frac{1}{2}$%.
7. $70.
8. $1037.24.
9. $5000.
10. $33\frac{1}{3}$%.

XII

1. 200,999.799.
2. 4000.
3. $142.92.
4. $15.20.
5. 1200.
6. 4166\frac{2}{3}$; 5882\frac{6}{17}$.
7. $91.
8. $1828.24.
9. $42.
10. $4200.

XIII

1. (*b*) $242.11.
2. $42.75.
3. $1440.
4. $72.50.
5. $93.50.
6. $555.46.
8. $2\frac{1}{2}$ ft.
9. $25 on $1000.
10. 30 ct.

XIV

2. $3\frac{1}{15}$.
3. 372.1.
4. 10.78.
5. $18.62
6. $9750.
7. $35.
8. $12\frac{3}{4}$.
9. 289.34.
10. 92.36.

XV

1. $333.20.
2. $11\frac{1}{9}$%; 100.
3. $21.04.
4. $324.
5. $4\frac{1}{2}$%.
6. $1350.
7. $750.
8. $4032; $3024; $5040.
9. 14 ft.; $13.44.
10. 820.

XVI

1. $299.73.
2. 2 yr., 9 mo., 28 da.
3. $2763.39.
4. $1246.56.
5. 75 ct.
6. 1st $33.38.
7. $64 loss.
8. $15 on $1000.
9. $8745.
10. $2.08.

XVII

1. 325 sq. rd., 12 sq. yd., $7\frac{1}{2}$ sq. ft.

2. $57.39.
3. $11\frac{16}{19}$%.
4. $40.38.
5. $839.79.
6. $50.47.
7. $570.
8. 5.22−%.
9. $\frac{1}{4}$%.
10. 2.

XVIII

1. 1,365,606.
2. $30.24.
3. 54 min., $29\frac{4}{5}$ sec. before noon.
4. (*a*) $12\frac{5}{8}$;
(*b*) $14\frac{79}{144}$;
(*c*) $443\frac{11}{28}$;
(*d*) $\frac{21}{55}$.
5. $64.72.
6. 810.
7. $2116.80.
8. 30%.
9. 1095.
10. (*a*) 96 sq. ft.;
(*b*) 2048 lb.

XIX

1. 315.75 mi.
2. $16\frac{2}{3}$%; $37\frac{1}{2}$%; 60%; $66\frac{2}{3}$%; 22%.
3. $\frac{1}{12}$; $\frac{3}{8}$; $\frac{9}{16}$; $\frac{1}{3}$; $1\frac{1}{4}$.
4. $25.30.
5. (*a*) $25;
(*b*) $94.50.
6. 0.0231717.
7. $\frac{33}{224}$.
8. $190.08.
9. $448.53.
10. $76.70.

XX

1. $6400.
2. $13.50.
3. 0.024; $\frac{7}{8}$.
5. 11.
6. $74\frac{101}{120}$.
7. $34.83.
8. 260.6319605.
9. (*a*) $\frac{14}{45}$;
(*b*) $2.70.
10. 3800%; 28%; 65%; 60%; $16\frac{2}{3}$%.

XXI

1. $252 including poll.
2. $1967.96.
3. $45.63.
4. $446.98.
5. $35,500.
6. $10,666\frac{2}{3}$ yd.
7. $23.
8. 2200.
9. 1st, 50 ct.
10. $224.

XXII

2. $175 loss.
3. $295.63.
4. 2 yr., 9 mo.
5. $400.
6. $15.03 loss.
7. 50%.
8. 1939.
9. $48.
10. $1313.

XXIII

1. 32 ft.
2. 108..
4. $40.
5. $300.
6. $200.
7. 210 bu.
8. $1250.
9. Latter, $18.75.
10. 40%.

XXIV

1. 55,607,455.
2. 2.77 A.
3. 44.
4. E; 10° 30′.
5. $16\frac{2}{3}$%.
6. $8.
7. 4 yr., 5 mo., 26 da.
8. $960,000.
9. 1682 sq. in.
10. $3\frac{1}{2}$%+.

XXV

1. 125,156.
2. 630 ml.
3. 382.92; 383.36.
4. 445.373; 445.227; 32.5069; 6100.
5. $201.60.
6. 50%.
7. 2d, $4.17.
8. $382.50.
9. 2827.44 sq. ft.
10. 198.8 mi.

XXVI

1. 178.22 Kg.
2. 61.81.
3. (*a*) $1\frac{3}{4}$;
(*b*) $20.0\frac{1}{3}$.
4. 123° 23′; 8 hr., 13 min., 32 sec.
5. 12; 5544.
6. 346.
7. 1 hr., 8 min., 46 sec.
8. $10.25.
9. 875 bu.
10. $53.94.

XXVII

1. 668,779.
2. $10.50.
3. $435.52.
4. (*a*) 35,068.7724;
(*b*) 6528.
5. $1312.50.
6. 50 ft.
7. $49.87.
8. $21; $721.
9. 69.
10. $14.48.

XXVIII

1. Lost $12\frac{1}{2}$%.
2. $38.25; $1236.75.
3. $26.15.
4. $40.93.
5. $409.28.
6. 1 yr., 2 mo., 21 da.
7. $540.
8. 77 ft.
9. Lost $800.
10. 40 rd.

XXIX

1. 43 ct.
2. $207.36.
3. 100 mi.
4. 9236.5 sq. ft.
5. 50 ft.
6. $24.75.
7. 116,640.
8. $14.28.
9. 19,353,600.
10. 18.77+.

XXX

1. 1152.
2. 3060 sq. ft.
3. $120.
4. $9.46
5. (*a*) $8.82; (*b*) $7.14.
6. $130.11.
7. $295.
8. 200 bu.
9. 250 mi.
10. 1385.4456 sq. ft.; 42 ft.; 21 ft.; 131.4972 ft.

XXXI

2. (*a*) $16\frac{1}{2}$ mi.; (*b*) $2\frac{7}{10}$ lb.
3. $12\frac{1}{2}$%.
4. $22.50.
5. $33.60.
6. 400,000.
7. $59.
8. $540.
9. $200.
10. 40 yd.

XXXII

1. 60 rd. by 240 rd.
2. 229.78+ ft.
3. $880.
4. $57.40.
5. $600.
6. 49 rd.
7. 72 ft.
8. 422.4.
9. $96.49.
10. 56 ft.; 132.4 ft.; 6720 sq. ft.

XXXIII

1. $12.50.
2. 20.
3. $4\frac{1}{2}$%.
4. 35 and 10.
5. $1.02; $1.70; $2.38; $3.06.
6. $\frac{1}{3}$; 6.
7. (*a*) 3.6; (*b*) $\frac{1}{8}$.
8. $12,000.
9. $405.
10. 100 times as great.

XXXIV

1. $82.50.
2. 490.87+ sq. ft.
3. 25 ft.
4. 800 ft.
5. 486 sq. ft.
6. 170 sq. ft.
7. 43.98+ in.
8. 360 ft.
9. 20 in.

XXXV

1. $3\frac{1}{3}$ cu. ft.
2. $63.65.
3. 13 : 9.
4. 72 yd.
5. 1176; 40 rem
6. $1700.
7. 56 ct.
8. 0.32844.
9. $959.67.
10. $975.61.

LESSONS IN ENGLISH

BY

FRED NEWTON SCOTT
Professor of Rhetoric, the University of Michigan, and

GORDON A. SOUTHWORTH
Late Superintendent of Schools, Somerville, Mass.

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